PACIFIC DISCOVERY

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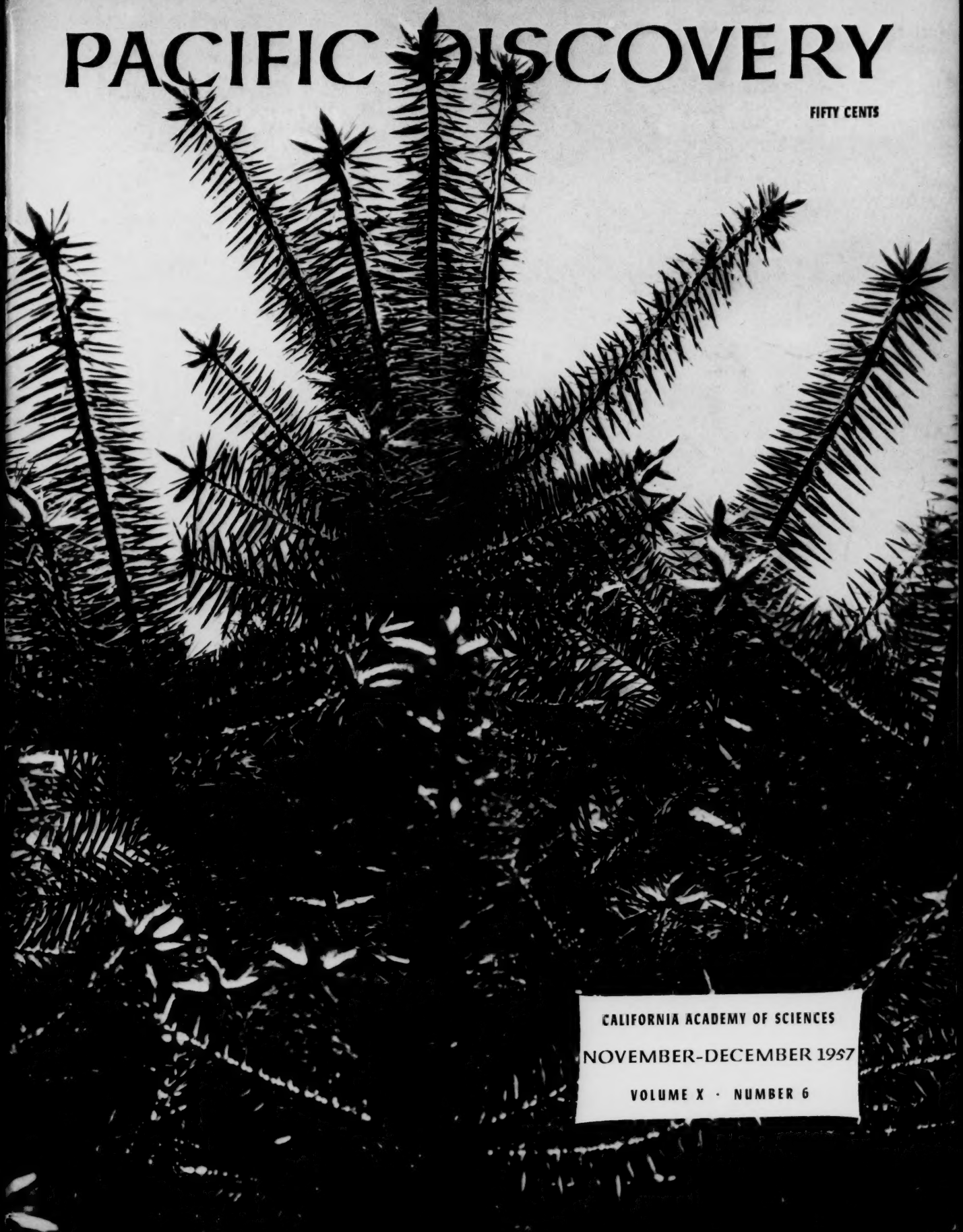

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PACIFIC DISCOVERY

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PRE-DISCOVERY

"ON GOING TO ANGKOR WAT" might be the title for an assigned classroom essay to be produced after reading some references to the world famous ruins of jungled Cambodia. It gives one a curious feeling to sit at home late one night, with a magnificent book of Angkor photographs giving the history of the place and discussing its art, and that essay title at the top of the page in the typewriter, knowing that next morning at 11:30 one will be on the way to Angkor Wat. Your "Angkor" may be the Taj Mahal, the Parthenon, the Pyramids – whatever great monument, whatever supreme place or thing you yearn to see on earth. You have been stirred by books, pictures, a lecturer with his film. You know in all reasoning sense that is as close as you will get. Then a spring is released: your dream moves toward waking reality. Elation is dulled by the detail of preparation; excitement is suppressed under the anxious pain of leave-taking. You are humble in the hope that you will be equal to your Angkor Wat. . . .

If a book can take you to Angkor Wat, it is surely this one mentioned above. The title is *The Arts and Civilization of Angkor*, and it is by Bernard Groslier and Jacques Arthaud (Frederick A. Praeger, New York, 1957). Your editor cannot hope to bring Angkor to you in future pages of *Pacific Discovery* in any way remotely comparable, and so urges you to see this book if Angkor is the place of your dreaming. Its authors are experts in its history and archeological investigation; and one, Jacques Arthaud, could not imaginably be surpassed in the photographing of its templed and sculptured aspects. It is hard to believe that one could be more truly awed by the actuality. And but for such a book one could see it without understanding it and how it came to be. *Pacific Discovery's* roaming reporter will do his best in the next few months to bring you some of the supreme things of the vast Pacific world, but trusts you will go nevertheless to the books such as this of Angkor, for the complete story.

D.G.K.

PD'S AUTHORS

THE SUCCESSFUL launching of Sputnik has almost certainly ushered in a new era of human accomplishment but **Dr. Robert Cunningham Miller,** managing editor and director of the California Academy of Sciences, has some doubts the event has brought out the best in the American character. . . . ¶ What many of us feel about the bay around us, **Harold Gilliam,** a San Franciscan, has put into well-chosen words in his book *San Francisco Bay,* a portion of which is reprinted here. . . . ¶ **Lillian Robinson Pérez** returns to our pages with one of her favorite topics, anthropology, especially that of Ecuador, where she lives. . . . ¶ **Patricia Bailey Witherspoon,** a newcomer to *Pacific Discovery,* writes as if she would really like to live on an equatorial island, with all due apologies to her hometown Denver, Colorado. . . . ¶ Another newcomer to PD's pages, **Tom Riley,** is a reporter for the *Oakland Tribune* who has the University of California (all campuses) as his beat. . . . ¶ **Philip Ferry,** veteran traveler not long returned from a trip around the world, stayed close to home for this one. . . . ¶ **Charles F. Hagar,** assistant manager of Morrison Planetarium, discusses a familiar sight in the winter sky, the Star of Bethlehem, and its man-made companion, the satellite. . . . ¶ As indicated above, *PD* editor and art director **Don Kelley** is just beginning a six-month tour of the Pacific area. While he is away **Johan Kooy** is art director and **Gary Barrett** is editor.

G.B.B.

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THE COVER

THE WORLD'S RAREST fir tree, the beautiful conical Santa Lucia fir, as photographed in East Bay Regional Parks Botanic Garden. (Photo by James MacBride. *See page 25*).

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EDITORIAL

HOW MANY MOONS?

WE AROSE EARLY one morning lately and went outdoors to look for Sputnik. Hearing footsteps in the driveway in that darkest hour that precedes the dawn, we thought immediately of prowlers and turned a flashlight in the direction of the sound. It revealed our next-door neighbor. Slightly embarrassed, we inquired, "Looking for Sputnik?" Slightly embarrassed, he replied, "Yes, looking for Sputnik."

This tiny satellite, seen by few but known throughout the world, has stirred the human imagination tremendously. Its eerie "beep, beep," heard on short wave radio by millions of ears, has given a sense of participation in a major break-through in man's conquest of his environment. It represents his first successful venture into space.

It is not unreasonable to compare the launching of Sputnik to the invention of the steam engine, the harnessing of electricity, the development of the internal combustion engine, the flight of the first heavier-than-air machine. Each ushered in a new era of human accomplishment.

We appear to be actually on the threshold of human travel into space. While the problems are formidable and may take years to solve, the people who are working on them know much more about what they are doing than the Wright brothers knew when they got their first primitive plane off the ground at Kitty-hawk, North Carolina, on December 17, 1903.

We happen to be acquainted with several qualified experts on rockets, and none of them is wild-eyed or impractical. They are careful, thoughtful, rather restrained men, working with ponderables and a slide-rule. Once we had occasion to drive one of these men to an airport. En route we asked him confidentially, "Do you really think space flight is possible?" He replied, "I have a nine-year-old son. I am telling him that in his lifetime it will be possible to make journeys to the moon."

It would be hard to think of a more earnest and persuasive statement. That was five years ago, and that is when this writer began to take space travel seriously.

It will still take a great deal of labor and ingenuity to solve the problem of getting men successfully launched into space, and – more important – of getting them back again alive and well. But at the beginning of this century the idea of men flying jet planes eight miles above the earth at speeds faster than sound would have seemed sheer fantasy. It is reasonable to suppose that space flight will progress as rapidly in the next half century as heavier-than-air flight has progressed in the last 50 or 54 years.

In the meantime we can explore the nearer edge of space with more and more complicated satellites which will signal back to us the things we want to know. Hitherto Earth with its single moon has been outshone by Mars with two, Uranus with five, Saturn with nine and Jupiter with twelve. Now we can have as many moons as we want and are willing to pay for. One of these will undoubtedly be a manned space platform from which to launch further explorations into space.

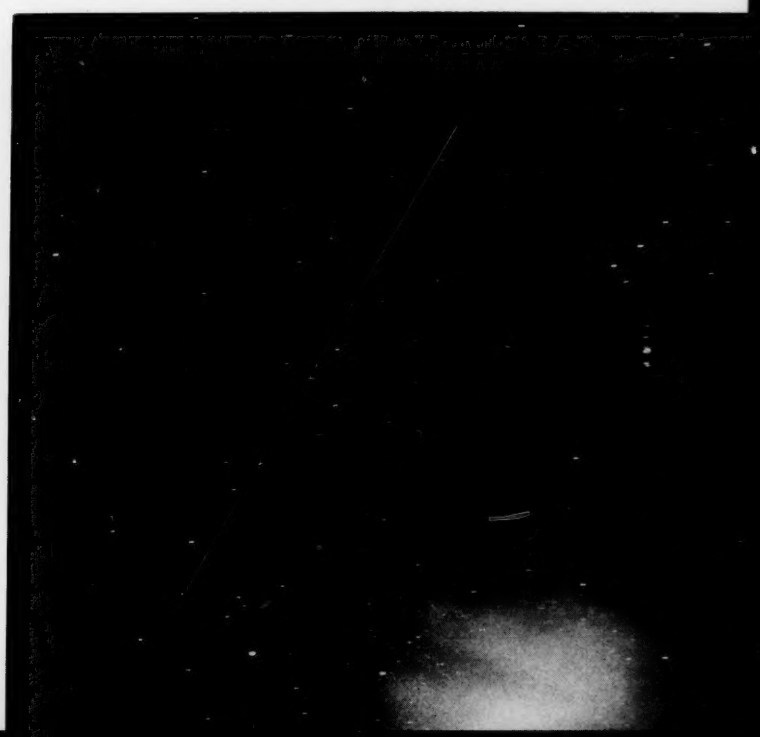
The fact that Russia was first in getting her satellite into space has not exactly brought out the best in the American character. We have in the past accused the Russians of self-delusion in claiming priorities on many well-known discoveries and inventions, and we have from time to time complained that, in the Olympic Games and elsewhere, they have not shown good sportsmanship. But when Russia achieved a genuine first in a major technological undertaking, did we leap over the net to congratulate the winner? We did not. We received the news in stunned disbelief, and then began to demand a congressional investigation.

We agree that launching a satellite is different from a game of tennis. But let's not call the Russians poor sports when we can't take a set-back with any better grace.

Sputnik has been bad for our complacency, but good for our souls. We have been too quick to assume that American technology is superior. Our science and engineering are as good as any in the world, but not necessarily better. The worst thing that can happen to a team in the habit of winning is to become overconfident. We are going to have to work hard and long and constantly to retain our slight edge of leadership in a highly competitive field. As the Red Queen said to Alice in *Through the Looking Glass,* "It takes all the running you can do to keep in the same place."

But to get back to our first paragraph, did we see Sputnik? We didn't, nor did we see its more easily visible companion, the third stage of the launching rocket. There were too many scattered clouds low in the western sky. We didn't see Sputnik, but we know it's there.

R.C.M.



Sputnik I's companion, the third stage rocket, streaks across the sky in this photograph taken October 20 by Roland Michaelis, Morrison Planetarium lecturer, from the Berkeley hills.

SAN FRANCISCO BAY: *The Changing Shoreline*

Harold Gilliam's "San Francisco Bay," an informal history and exploration of the bay around us is meeting with almost unanimously favorable reception. Reprinted below is a portion of the excellent chapter describing how the bay's shoreline is changing, copyrighted 1957 by Harold Gilliam.

IN MAN'S BRIEF SPAN of time on earth he regards the main features of his environment as permanent, much as one would glance at the single frame of a motion-picture film and fail to see any movement. But the processes which formed the bay, like those which created the earth and everything upon it, are unceasing, and man's glimpse of them in his lifetime reveals but a static interval in an endless continuum.

The sun, the rain, the wind, the ice, the rushing waters, and the moving sea are engaged in endless action and reaction, moving interminably in processes which not only seem to reach endlessly back into the past but also stretch far beyond man's dim vision into the future.

If the bay, and its shores, as we know them, are regarded not as a completed project but as some intermediate state in a long geologic evolution, what can be said of its future?

Geologists seldom make predictions. There are too many unforeseen factors that can enter the picture to confound the prophets. But the layman is free to indulge his imagination—to consider the clues and piece together a picture of what may happen.

Attack and counterattack

As we have seen, the creation of the bay may be looked on as a series of conflicts between elemental geologic forces. The first conflict, between the ocean and the rising mountains of the Coast Range, was won by the mountains; and the ocean was rolled back nearly one hundred fifty miles. Then, in the struggle between the river and the mountains rising to block its course, the river was victorious and carved through the mountains the two gorges of Carquinez and the Golden Gate.

In the succeeding conflict between the river and the ocean the winner was the ocean, encroaching first on the river's delta, then invading and overwhelming its course for more than forty miles upstream to create the bay.

But the river has long been engaged in a massive counterattack to reclaim its own – to push back the ocean and turn the bay into a valley once more. With the same powerful cutting action that enabled it to slice its way through the mountains, it continues to carve out its channel. Most of the material scooped from its bed and from thousands of miles of its tributaries—material it once deposited in the great delta outside the Gate—is now laid down in the bay itself.

Over the bay bottom the river has spread thick layers of mud, silt, and sand in some places three hundred feet deep. For example, the ridge which now supports the Bay Bridge, extending from the bridge's western anchor on Rincon Hill to Yerba Buena Island, has been buried under more than one hundred feet of mud. Measured by this standard, the bay is already more than half filled with sediment—halfway to being reconverted into a valley. In this effort to drive out the ocean, the river has small but potent allies. Around the edge of the bay, particularly on the Marin shore, where the hills rise steeply, there are canyons whose lower reaches were flooded by the advancing salt water as the ocean rose, creating what the geologists call "drowned valleys." Just as the bay itself was the drowned valley of the main river, so the arms of the bay extending back among the ridges are drowned valleys of tributary streams. These streams are themselves bringing down from the surrounding canyons great quantities of mud and silt, depositing them in the calm waters just offshore.

As the shore waters gradually become shallower, plants grow from the bottom, and the tidal marshes are created, intermediate stage between water and land; a marsh is a sign that the salt water is losing the struggle with the force of the streams. More sediment is deposited until it rises above sea level and becomes dry land.

As an illustration of how the streams are building their deltas and driving back the bay, drive north across the Golden Gate Bridge into Marin County. In the fifteen miles north of the bridge on Highway 101, you will cross three such drowned valleys. Large areas of the towns of Mill Valley, Corte Madera, and San Rafael have each been built on soil which was once part of Mount Tamalpais and was carried by streams to the edges of

drowned valleys, where it became first marsh, then dry land.

Directly across the bay is another example of the way the streams are changing the shoreline. A five-mile-long ridge known as Potrero San Pablo rises five hundred feet above the bay and was probably at one time an island. Mainland streams built deltas out from the shore until they reached across the intervening strait and converted the island into a peninsula. Part of the city of Richmond now occupies much of this delta land. The largest of the bay's stream-built marshes are those at its extreme ends. Most of the peninsula cities along El Camino Real, three and four miles from the present shoreline, were constructed in areas which were at the water's edge before the bay was pushed back.

Considering only the advance of the marshes and the sedimentation of the bay, one might easily conclude that the river and its allies were winning their battle to reclaim the bay from the ocean and convert it into a valley again. But the ocean, meantime, is engaged in a counteraction of its own.

At several places around the shores are large artificial mounds which offer significant clues to the bay's future. They are the remains of Indian villages. There archaeologists have uncovered great quantities of clam and mussel shells, ashes from campfires, crude household implements, and human skeletons—all representing the residue of the centuries before the coming of the white man.

Such mounds are common in California, but some of the specimens found around the bay were distinguished by one curious fact: at least ten of them, on both sides of the bay, were partly submerged. One mound near Richmond—about six hundred feet long, thirty feet high and estimated to have contained three thousand human skeletons —was two thirds under water at high tide.

Archaeologists were puzzled. The Indians would scarcely have chosen to live on a site covered by water; they would have occupied an area of the beach at least high enough so that they would not be sprayed by waves at high tide.

There seemed to be only one explanation: The bay had risen some twenty-five or thirty feet since the mounds were first occupied about three thousand five hundred years ago. The rate of rise—slightly less than one tenth of an inch a year—tallied roughly with the calculated elevation of sea level from the melting of the ice sheet.

Thus it appears that the process which created the bay is still going on. The weather continues to get warmer; glacial ice all over the world melts (mountain glaciers on the Sierra peaks have been irregularly retreating inch by inch since they were first discovered and measured by John Muir in 1871) and the sea advances on the land.

These, then, are the primary forces arrayed on each side in the struggle for the bay's future. The river and the streams are tending to diminish the bay by depositing sediment on the bottom and building deltas at certain points around its edges; the ocean meantime is tending to make the bay larger by raising the water level and, in areas where there is no stream sedimentation, is actually advancing on the land.

The deluge

The outcome of this war of the elements is uncertain, but distinct trends can be noted.

At present the river is the swifter of the two forces. Its sedimentation can be observed over a period of decades; the ocean's advance—slowing down because of the shrinkage of the icecap—can be measured only in thousands of years.

Consequently, if the two forces continue to work at the present rate, the river will be an easy victor. Relatively soon, possibly within a few thousand years, it will drive the ocean back out of the Gate; the valley floor will roughly correspond with the level of the present bay.

But the river's victory will be short-lived. For, if the ocean continued to rise until all the earth's ice was melted, it would eventually stand more than one hundred feet above its present level. It would again push through the Golden Gate, invade the valley, and rise to new heights, creating a bay more than twice as large as the present one.

If this eventuality comes to pass, the fate of the Indians' shell mounds will befall the cities of their successors. Year by year high tides will reach new levels. Beaches such as San Francisco's Aquatic Park will disappear first. Homes built on low, filled areas around the margins of the bay—if they still stand—will have water first at their doorsteps, then at their window sills.

Man-made Treasure Island will be submerged relatively soon, and eventually only the highest peak of Alcatraz will be visible above the swirling waters at low tide. Waves will roll through the streets of peninsula cities, and although the University of California, at the foot of the Berkeley Hills, will stand above the high-tide mark, most of the Stanford campus, at Palo Alto, will be sub-

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may

merged, giving U.C. rooters their final triumph. The bay will extend southward beyond San Jose, filling most of the Santa Clara Valley, and northward will overflow into the Russian River, forty miles from the present shore.

In San Francisco the waters will surround the Ferry Building and creep up Market Street, spreading out in the low regions until the downtown area is a cluster of islands formed by the peaks of Nob, Telegraph, and Russian hills, and only the top stories of the tallest skyscrapers protrude from the bay's surface—remnants of a drowned city.

If the bay level continues to rise at the present rate, this deluge will be complete in a short time—possibly ten thousand years.

This picture of the death and rebirth of the bay is, of course, highly speculative. It presumes that the river will continue to deposit sediment and the sea will continue to rise, but it is possible that neither process will be carried through to completion. Man himself may slow down or eliminate sedimentation by dredging or diverting the rivers upstream. On the other hand, he may himself continue to fill in the bay for building purposes, replacing the river as the agent of the bay's destruction. Even so, he would still face the threat of the rising ocean.

It is possible, however, that before the ocean drowns the coastal cities, it will cease to rise. As has happened several times in the past million years, the weather may cool off and the ice may return. Then the ocean would withdraw again and leave the bay dry until the next big thaw.

But by that time another force may re-enter the picture to alter the entire landscape in unpredictable ways—the changing crust of the earth itself.

Look out again from Land's End at the relic rocks of the Farallones and remember that in the long reaches of geologic time even mountain ranges are scarcely more permanent than waves on the surface of the ocean. The Coast Range may rise to new heights; it may be recast into unrecognizable new shapes; it may erode away and again become sea bottom. Then the cycle which began when the range first appeared above the surface of the ocean will be complete.

The larger forces of nature are as yet unalterable by man. The best he can now hope to do is to retard some of the minor processes and speed up others, puttering around the margins, allying himself now with one force, now with another, in his lifelong attempt to make his brief existence on earth more comfortable.

Until such time as he is able to affect the motions of the planet's crust and the changes in its sheath of atmosphere, the only certainty regarding San Francisco Bay is that, like every other feature of the landscape, it is transient. In time it will give way to newer forms just as surely as will the trees which bend before its winds or the human beings who now live on its shores.

* * *

The shrinking bay

Ever since the first forty-niner hauled some dirt from the foot of Telegraph Hill and dumped it into Yerba Buena Cove, thereby making himself owner of a valuable waterfront lot, men have been remolding the bay's shores, extending them outward and carving them in various ways for harbors and ship channels.

Much of downtown San Francisco rests on bay bottom. The waterfront was gradually moved from the original beach along the line of Montgomery Street half a mile into the bay. North Beach, too, now high and dry, was once a real beach just northwest of Telegraph Hill. Much of the debris from the earthquake and fire of 1906 was dumped into the cove there, and workmen excavating for the Aquatic Park in the late 1930s dug up remains of the disaster, even including watches, jewelry, and foreign coins.

Most of San Francisco's Marina District was once part of the bay and was filled in for the Panama-Pacific International Exposition of 1915, from which is left only the crumbling but still-impressive Palace of Fine Arts. South of the Ferry Building the Mission Rock ship terminal is the only reminder of now-filled Mission Bay, the original anchorage for Mission Dolores.

An opposite process created the island of Alameda, a peninsula until 1902, when the Oakland estuary was extended around its southern end. Both San Francisco and Oakland airports were built where until recently tidal water flowed through winding channels, and farther south along the peninsula postwar subdivisions are increasingly occupying thousands of acres of drained marshes. The city of Berkeley plans to drain and develop several square miles of bay bottom, and most of the other communities along the shores have similar projects.

The current rapid encroachment of residential

"California's vital inland sea"—the fabulous San Francisco Bay—photographed from more than 20,000 feet in the air. The plane was over the hills of Marin; the Golden Gate Bridge and San Francisco are at right center and East Bay cities may be seen slightly above left center. (Clyde Sunderland Aerial Photographs)

subdivisions and industrial sites raises a serious question about the bay's future. Although its size has not yet been appreciably diminished, planners must consider how much of the bay it is desirable to fill in. Conceivably it would be feasible to drain or fill all of it not necessary to shipping; and if present trends continue, this is a distinct possibility. But it is not necessarily a desirable one.

For most of the bay to be replaced by mile after mile of solidly built-up suburbs would be to eliminate the area's greatest natural advantage. The bay is not only useful as a harbor; it has other functions as well. It is in effect a huge untrodden park, offering space, perspective, and beauty — items which are not usually visible on a balance sheet and which will inevitably become increasingly rare as California's population increases to three or four times its present size. In the metropolitan regions such areas of natural space as still remain —and this includes the bay—should be jealously husbanded.

This does not mean that there should be an end to tideland development but rather that development should be planned to take advantage of the opportunities offered by the bay's presence. The possibilities of the shoreline for parks, beach resorts, and waterfront homesites have been scarcely explored.

Toward a planned shoreline

Unfortunately most of the developers of newly subdivided areas have simply dumped fill material into the water and built on top of it. Residents might as well live in the middle of Kansas for all the use that is made of the bay.

There have been encouraging exceptions, however. The first residential area to be developed with an imaginative eye for the potentialities of bay-front living was Belvedere Lagoon. The lagoon was partly-filled by man-made peninsulas, and houses were built along the water, many with private docks in their back yards. A similar develoopent on a much larger scale is Alameda's South Shore Project, a complete community built on filled land, including 1000 homes—some of which will be directly on lagoons — shopping centers, schools, and parks, plus a public beach on the perimeter. An even larger project is planned immediately south on the tidelands of Bay Farm Island.

Even these well-planned communities present problems, however. The South Shore Project caused a furor among residents of the original waterfront whose bay outlook was blocked. And the Bay Farm Island development is to occupy tidal flats which have long been one of the region's principal way stations for migratory waterfowl. Admittedly it is more important to provide homes for people than campsites for birds, but certainly consideration should be given in other areas to the preservation of some of the few remaining natural shores for the study and observation of the abundant wild life as well as for recreational areas for the great majority of bay area residents not able to live along the shores.

Richardson Bay, for example, is the prize in a desperate race between developers, who want to fill it in, and residents of Marin who are carrying on a campaign to make its remaining edges a state park for small-boat landings, recreational beaches, and a wildlife refuge. The conservationists, as always, face an uphill struggle against those who see in the natural shores only a chance to plant more buildings. And they fight a frequently losing battle against time. The few shores available for parks are fast disappearing.

Fortunately the most spectacular and historic section of the bay's shores, the Golden Gate, has so far largely been spared from the subdividers. The entire north shore is in the hands of the Army, which has thus far left most of the area in its natural state. The Army's Presidio occupies much of the south side of the Gate, and most of the shoreline there is still in a relatively natural condition, although San Francisco interests have exerted increasing pressure in recent years to acquire the Presidio or parts of it for subdivision purposes, and the Army itself is expanding its own housing projects there.

Farther west San Francisco-owned Land's End has similarly been spared, except for some ill-fated attempts to build roads along the cliffs in slide areas. These ocean-battered cliffs and the rock-strewn beaches below them offer a magnificent exhibit of the continuing action of some of the processes which formed the bay, as the ocean rollers constantly attack the headlands, exposing twisted layers of rock laid down in the ages before the river carved this gorge. It would seem fitting that both shores of the Golden Gate—or at least as much of the area as is no longer necessary for defense purposes—be incorporated into a state or national park, while there is still time to preserve this incomparable shoreline against all encroachment. • • •

(See review, page 32)

THE TZAXILA INDIANS OF ECUADOR

LILLIAN ROBINSON PEREZ

ON THE SLOPES of the western mountain chain of the Andes in northwestern Ecuador, there lives a tribe known as the Colorado Indians, the name that was given them by the colonial Spaniards because of their cinnamon-colored skin and because they paint their hair and skin with the red annatto seed.

The Colorados, whose name for themselves in their own language is Tzáxila, are a good looking, gentle, and honest human group; they lead a simple life hunting, fishing and cultivating on a small scale their banana and orange groves, cassava, tobacco, cacao, and coffee. They get enough balsa wood and rubber from the untamed forest around them to enable them to trade in the mestizo settlement of Santo Domingo de los Colorados for salt, thread, needles, soap and other products of the outside world including sugar cane *aguardiente* or, literally, fire water.

This Indian group is now pitifully reduced to about five hundred persons, living in their family tribal huts at some distance apart. They keep to themselves and through their very Indian trait of tenacity and traditionalism have managed to remain pure in blood and in language in spite of the encroaching whites and mestizos from the eastern

PHOTOS BY BODO WUTH

Tzáxila Indians, like many of the world's people, apparently approve of the bull session. Here the men gather for a chat on their long, low balsa wood benches.

Andean highland and the Negroes from the coast. The Tzáxilas' language is one of the few pre-Inca languages still spoken.

In the course of years I have visited the Tzáxilas several times and have found with them a strange relaxation like that one finds in the company of children who do not dissemble what they feel and from whom we have grown away so much that they fascinate us because we see in them our own first spontaneous reactions, before society and environment pressed us into a mold. The last time I visited the Tzáxilas I went there with an assorted group of friends – one or two painters, writers, and an explorer.

Our journey – by station wagon and jeep as far as the settlement of Santo Domingo and thereafter by mule and horse – brought us to the semi-tropical forest where the Tzáxilas live and where even the waters of the Río Cungumita seem to be tinged with red. Starting from the city of Quito, we rode along a shelf road on the serrated mountain heights, climbing down to the settlement of Santo Domingo where we stayed overnight. The next day we rode on horseback through a narrow trail where our beasts plodded through muddy patches or bordered yellow-coated swamps with their distinctive odor of hot rotting vegetation and stagnant water. For periods of time all view of the sky was lost and although it was a brilliant hot day in the semi-tropical forest, the light only filtered to us through the green, heavy, and rustling dome of intertwined branches of trees high above. As we rode on, the usual sounds of the settlement and neighboring plantations were left behind us and only the forest sounds of buzzing insects, shrill cicadas, and here and there a frightened animal rushing into the underbrush, accompanied us in the somnolent woods which were for the most part solitary and uninhabited. At last the human habitation of the Tzáxilas was heralded from afar off by a few singles notes of their melancholy, primitive xylophonic music.

After fording a shallow stream we came to an even narrower trail and at last emerged, quite tired after four hours of unaccustomed riding, into a clearing before the huge thatched tribal hut of the Aguavil clan, and our guide asked for the chief, Ramon. One of the youngest of Ramon's many sons came out. He was a little fellow of about six, with cinnamon skin and black, slanted, mischievous eyes; his only covering was a striped loin-cloth. He looked at us and disappeared into the semi-darkness of the hut where Ramon, sitting with four generations of his family, was probably pondering whether to receive us or send us away.

Piní, the little boy, came back to tell us that Ramon was ill with whooping cough and was in no mood for visitors. Our guide was not to be put off and started calling in a loud, aggrieved voice, asking Ramon if he was going to behave so badly when he had brought a few friends to see him, until at last Ramon came to the threshold.

He was a tall strong man whose light brown skin was painted with the red annatto seed, known all over the Andean highlands by its Quechua name of *achiote* and which is used as a dye and food coloring. The Tzáxila name for the tiny red seed is *mú*. Ramon wore a short white cotton skirt with red and black stripes which was also impregnated with the red color of mú, but he had not put on his ceremonial paint. He spoke to us in his own peculiar Spanish and told us that there was a whooping-cough epidemic in the settlement and that he himself had been very ill. He agreed to let us camp in his clearing, under his front porch, which consisted of a large space of pounded earth, covered

A handsome young Tzáxila girl holds the red *mú* seed pods. This coloring is used in food and as body and hair paint.

by a thatched roof supported by poles and the front wall of his hut.

Having decided to receive us, he pulled down one of the long, low balsa-wood benches which were propped against the wall and sat down regally on it. He spoke to the men of our party for a few minutes and ignored the women completely. During the chat, several adolescent and younger boys came out and partook of the *aguardiente* we offered them, as is the usual custom. They drank the fiery liquid at one gulp, without batting an eyelid, and returned the glass with a somewhat disdainful gesture.

After a few words and not having smiled once, the chief got up and went inside his hut. Through the bamboo slits of the tribal house we could feel the curious gaze of the Tzáxilas on us as we hung our hammocks and prepared camp.

At dawn next day our guide left with the horses and mules to go back to Santo Domingo. We begged him to send a doctor and all the medicines he could, to see if we could help the Tzáxilas since both children and adults seemed to be susceptible to whooping-cough. Meanwhile Ramon accepted what help we were able to give him and asked us to do what we could for one of the less important witch doctors, Apolinario, who was very ill and lay gasping in his hut across the river. We only had a few aspirins and some cacao fat with us but we did what we could with them.

During the day we installed our camp and started making friends with the children who were the only ones that would come near us then. At dusk, a young hunter called Dalmacio walked in from the darkness and, leaning against the supporting pole of the hut, looked us over with seeming disdain and then concentrated his gaze on our fire. Dalmacio — what a strange name, I thought, for this half-wild creature! We learned later that the Catholic priest from Santo Domingo rides down once every three months to baptize, marry, and bless the impassive Tzáxilas. After they have been baptized by rote, with the names of the saints and martyrs in the Church calendar, they learn their Christian name which is the one they use to outsiders; their own Tzáxila name is not parted with so easily. Dalmacio wore a striped white, red and black skirt high above the knees, a red girdle around his waist, and heavy coarse silver bracelets on his forearms, which he had crossed over his chest as he listened intently to the Spanish song that Guayasamin the painter was singing to the accompaniment of a guitar. Olga surreptitiously brought out a sketchbook and started to draw by the light of the flickering fire. Dalmacio turned a stony stare towards her, then haughtily turned on his heel and disappeared into the night.

After this fiasco we decided to turn in for the night. We had just fallen into an unquiet slumber when it was broken by a shriek which started high up on the scale and came despairingly down, in a long drawn wail, to the muted sob of a woman. I felt as if I had been lashed with an icy whip along my back and, awake now, I realized that it was one of the women in Ramon's hut. Torches were lit, we heard steps and the slurring voices of the Tzáxilas. The wailing would start again on a shrill note and descend down the scale in one never-ending lament. We found later that a child had died of whooping-cough and its half crazed mother, holding it, was trying to bring it back to life.

After a few tense hours we tried to forget the

Preparing to adorn his paintless body, a Tzáxila boy opens a red *mú* pod.

tragedy of this unnecessary, primitive death and go back to sleep when we heard a shot from the other side of the river. We were awake again in a flash. The shot was repeated, this time in Ramon's house, and twice again from different points of the compass. Then through the dark gaps of the jungle paths the silent, apparently unmoved Tzáx-ilas came. Painted with their ceremonial designs, carrying lighted torches of copali, resigned but uncringing in the face of death, they assembled in the clearing. Then they filed out across the river and disappeared into the woods, leaving us, the intruders, worried and uneasy.

Piní darted out of the hut like a mischievous goblin and told us that Apolinario the witch doctor was dead. The shots had been fired to speed him on his last journey and to assemble the tribe to take part in the funeral ceremonies. No worse news could have been given to us. Would we be blamed for his death, we wondered? We waited unhappily for dawn thinking that it would not be unusual for such a haphazard trip to end in tragedy.

The next morning Ramon returned. He was unpainted but wore his usual striped skirt and, as a concession to the cough that still shook him, a long ivory-colored cotton mantle like a toga, and sandals; he looked like a reincarnation of some ancient Roman emperor. Uncertain as to whether his intentions toward us were friendly, we rather timidly asked him to share our coffee and biscuits. At once the Roman emperor became a smiling and happy human being. He told us that Apolinario was a great witch-doctor and although he had indeed died, on learning how sad his brothers were, had decided to come back to life once more. This

Primitive marimba music and strong sugar cane *aguardiente* are good ingredients for a masculine fiesta in a man's world.

was heartening news and in the clear daylight we could laugh at our fears of the previous night.

Ramon's wife Maria was already a great-grandmother. She wore the usual striped skirt which came down to below her knees, and her long, lank, unpainted hair reached to her waist. Her face was Mongolian with high cheek-bones, oblique eyes, and a yellow malarial skin. Her neck was decorated with beads and seeds of various colors and her old breasts were flaccid and pendulous. Altogether she looked like an old gnarled and sapless plant. When her husband spoke in public she maintained a discreet and dignified silence, but in the night through the thin bamboo partition we could hear her mumbling and nagging monotonously, telling off her regal spouse.

During the day she would disappear along the muddy trails with a woven basket hanging from her head and would bring back loads of red seed, bananas, cassava or firewood. She always smoked a corncob pipe which, although it gave her long upper-lipped mouth more of an ape-like look, at the same time made her appear aloof and philosophical.

We invited Ramon and his wife to lunch with

↑ **Even the youngest Tzáxila children are "beautified." With their paint and their striped cotton skirts, this mother and child are completely dressed.**

← **In full ceremonial paint, a fourth generation member of the Aguavil clan seems uncertain about having his picture taken.**

us. He appeared with a lordly air and she shuffled humbly behind him and at our indication sat beside him on the bench, although the customary Tzáxila practice is for the women to eat by themselves after they have served the men. Our guests ate with gusto and had second helpings of everything and when we had all finished they burped sonorously and sat on in satisfied contentment. Maria brought out her corncob pipe and gazed across into the woods as we tried, without success, to draw Ramon into conversation. He gave us half smiles and a guarded grunt of assent to this or that, but no more. We asked Maria why she never smiled and suddenly in quite good Spanish she answered "I smile inside."

Another member of the tribe was Belisario. By common consent we decided that he was the wise man of the Tzáxilas. One afternoon we went to visit him at his home across the river. It was of a primitive opulence and boasted a sugar-cane mill and a mortar to thresh rice. Around the hut were big cultivated fields and it had a well-stocked larder of wild pig meat, fish, plantains, oranges, cassava, and sweet potatoes. Under his veranda he had a marimba or rather a primitive chonta wood xylophone which, to our delight, he and his son, Topi, played using sticks muffled with crude latex rubber. The melodies were sad and liquid and were all about the wind and the river. He called them "fierce water," "soft water," "whirlpool."

Belisario described for our benefit the funeral ceremonies of the Tzáxilas. They paint their bodies red from head to foot, then they paint themselves with horizontal black stripes from under the eyes to the ankles, put on their coarse silver bracelets, their short striped cotton skirts and red girdles, and in the night they gather in the house of the dead. One of the elders comes up slowly with a lighted torch and the *tensasa* – one of the funeral games they play to while away the vigil of the dead – begins. The lighted torch is thrown by the first man in one row across the rigid body to the first man of the row on the other side, and successively all down the two lines.

When one of the mourners fails to catch the torch or catching it by the burning end lets it drop, he has to offer a drink to all those present and once the sugar cane fumes start to work they begin to chant their regret for the dead and his long list of accomplishments and virtues. After the long night vigil is over and the pallid dawn lights the scene, those who have been dearest to the dead man lift him, walk through the forest to their burial place, lay him on the hollowed trunk of a chonta-palm and bury him; while the women gesticulate, tear at their hair, and wail. Around the dead man's breast and over his heart they tie a strong vine which, when he is buried, is left above the ground. The other end is tied to the thatched roof which protects the grave from the rain and the wind. As long as the cord remains unbroken, the Tzáxilas believe that the soul still lingers around the tomb; but once the cord is broken they weep again for the soul of the dead man which has finally abandoned the body and departed on its last journey to the place of the gods.

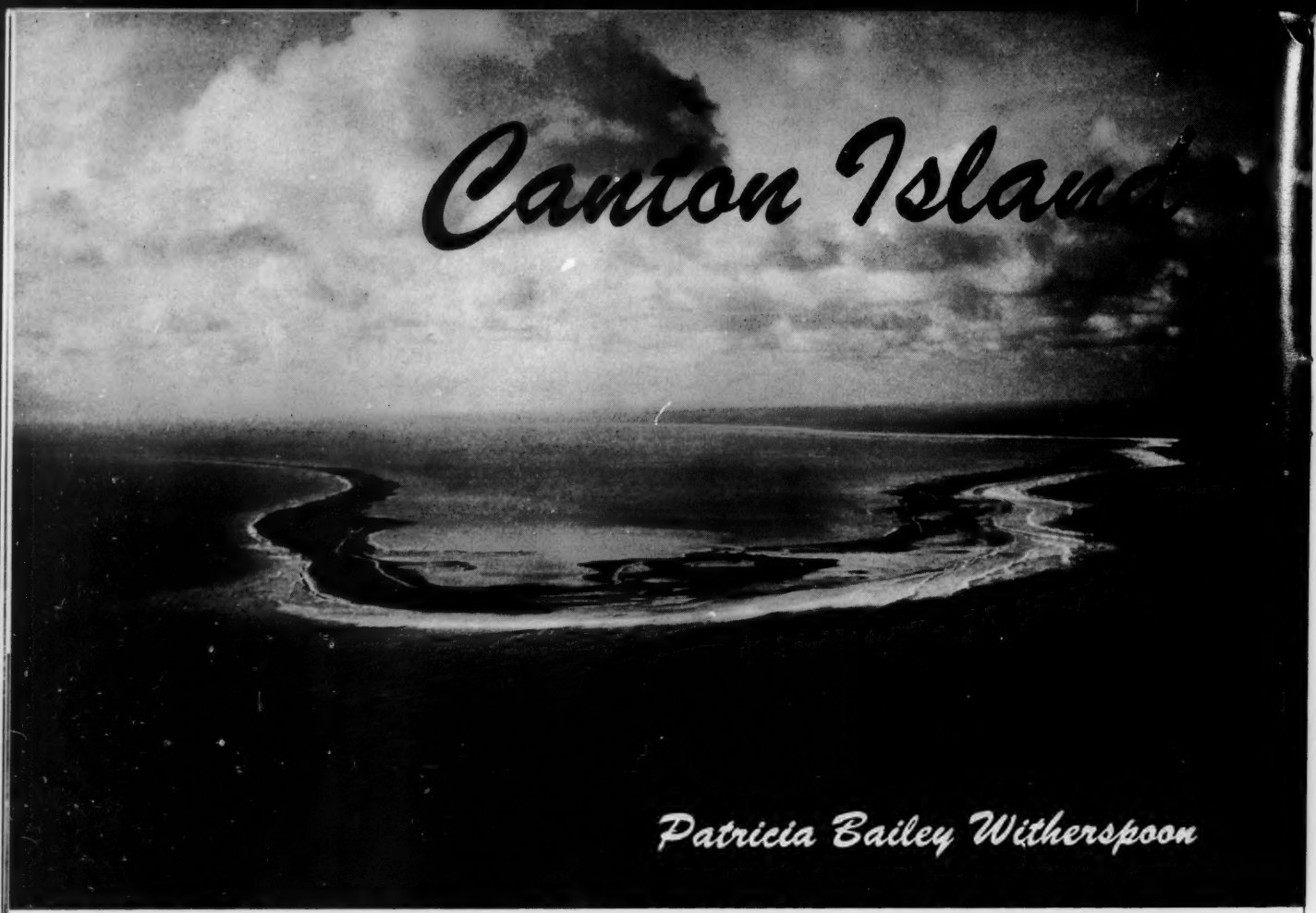
When a strange disease or tragedy accompanies the death of a man, the Tzáxilas burn his hut to the ground and abandon his fields so that spirits of sorrow, death, and disease may have no place to linger in and cannot remain in the settlement to afflict other members of the tribe.

After we had stayed with them a few days, the Tzáxilas began to lose their shyness. At sunset Guayasamin would bring out his guitar and start playing. This more than anything else brought the Tzáxilas to our camp. Dalmacio even began to learn to play the guitar which the painter promised to leave for him when we left. Even the most timid of them would squat silently in the darkness on big banana leaves placed on the ground and the bolder ones on benches near the light and the music. We obtained a fair amount of notes; the explorer a good collection of reptiles; the painter an assortment of Gauguinesque sketches and gouaches of flaming reds, greens and blacks; or, when depicting the woods, the green hidden and softened by the drifting mists, or the high pale and rainy skies. We all had a feeling that our creativeness had been tended, watered, and enlivened in the land of the Tzáxilas.

On our last day our guide returned with horses and mules to expel us from our newly found haven. We said good-bye to them all. Ramon told us he was sorry to see us go and promised to weep for us until the waters of the Cungumita should rise in a red flood and bring us back.

We mounted on our horses and made our way to the trail. The last Tzáxila we saw was Piní, the slant eyed goblin, who surprised us as he had often done before by jumping suddenly from a tree ahead of us on the trail and darting into the undergrowth with a long screech of uncontrollable laughter.

Small as he is, a Tzáxila boy stands unafraid in the shallow stream, lord of all he sees, at least for the moment.



Canton Island

Patricia Bailey Witherspoon

Photos by the author and Alfred M. Bailey-R. J. Niedrach

EVERYONE – almost – has dreamed of visiting an equatorial isle where sunlit beaches are lined with waving palms and where at night starry skies gleam over a peaceful lagoon. My own dream was realized on little Canton Island, a coral atoll nearly 2,000 miles south of Honolulu. We were on a 7,000-mile flight to Australia, and Canton, almost on the Equator, is one of the stepping stones where planes stop for a brief half hour to refuel. Built on a rim of an ancient volcanic crater, the narrow winding ribbon of land varies from only 100 yards to a half mile in width, and extends 29 miles around a colorful lagoon. It is not a large island in the vast Pacific but certainly an important one.

Only seven hours ago we had been in Honolulu and now we were over the Phoenix Island group straddling the Equator. It was around midnight when the pilot announced over the loud speaker, "we are approaching Canton and will be landing in a few minutes." I pressed against the too small window peering into the darkness to see moonlit Canton Island looking like a silver thread of sand separating the glistening lagoon from the wave-washed beaches of the ocean. Our plane, the *Bald Eagle,* circled the coral atoll, then dipped its wings swooping onto the landing strip.

I had anticipated this visit for years, a chance to see and photograph the abundant bird life of Canton, the wonders of which I had heard from my father.

It was a welcome surprise to be met by his friends, Bill Evans, chief of the Civil Aeronautics Authority, and Dick Slater, Pan American representative. They led the way through the terminal building where outside in the moonlit courtyard we paused momentarily beside the unique sign that lists distances to remote cities throughout the world – Calcutta 10,070 miles; Havana 6,936; Rome 11,366; New York 7,049; London 10,501; San Francisco 4,468; etc. Was it possible we were so far away from everywhere?

Beyond was the attractive Pan American Lounge where we joined the other passengers in a midnight snack. I was intrigued with the tremendous maps covering the walls on which little Canton, just one of

➔ With its palm trees bowing ceaselessly in the Easterly Trade Winds, Canton Island is important for its beauty, its abundant bird life and as a refueling stop for planes en route to points in the Southern Hemisphere.

← Some 2,000 miles south of Honolulu, Canton Island — nearly on the Equator — is a small coral atoll stretching 29 miles around a lagoon. (U. S. Signal Corps Photo)

many thousands of coral atolls in the South Pacific, is barely a pin point. Regardless of its small size, its strategic location as a base in peace as in war now has been fully demonstrated.

Probably the first white visitors to Canton Island were American whalers back in the early 1800's who came ashore for green herbs, or birds and eggs to replenish their food supply. Because of the desert conditions, with only scant vegetation and little animal life other than birds and crabs, and no fresh water, the whalers, no doubt, considered Canton uninhabitable. Before the whalers, Polynesians may have touched these shores but there is no definite proof. In 1852, a whaleship named *Canton* crashed on the atoll's reef. The entire crew of 33 men got ashore and soon after set out to sea in four open whale-boats, reaching Guam in 49 days after traveling 3,200 miles. Twenty years later, in memory of these intrepid sailors and their ship, the island was named.

Canton became front page news in 1937 when American and New Zealand astronomers came to study the total eclipse of the sun. These men were the first to realize the island's true potentialities and both Great Britain and the United States laid claim to the land. Soon colonists came to maintain bases. Then, two years later, both countries by an act of law assumed joint control of Canton and its neighboring island Enderbury, declaring them a Condominium to last for fifty years, and "thereafter until such time as it may be modified or terminated by the mutual consent of the two governments."

The greatest activity on Canton Island was during World War II when more than 30,000 soldiers came to help secure our position in the Pacific. They built landing strips, put up buildings and made a roadway around the island. Today, eleven years after the war, there is less activity, but it is still a busy place with about 300 employees of Pan American, Civil Aeronautics Authority, and the British occupying the north and south sides of the island. A narrow channel cutting into the lagoon from the sea separates the northern community from its southern neighbors; however, a diesel powered ferry takes passengers across the lagoon and there is a bumpy 26 miles of road circling the island.

While our fellow passengers reboarded the *Bald Eagle* to continue on to Fiji and Australia, we climbed onto the little ferry and were soon chugging over the dark lagoon waters leaving behind a silhouette of palm trees bent by easterly trade winds. Landing on the south side dock, it was a two-minute walk along a stone path to the hotel, a typically tropical one-story affair with spacious bedrooms equipped with fans and mosquito netting. I glanced at my watch as I fell into bed at 2:30 A.M.

Bill Evans drove us, next day, in his station wagon around the north side community pointing out the centers of interest: the grocery store which has supplies flown in weekly; the hospital, a quonset hut staffed

by a husband and wife team; a local radio station; the fire house, another quonset building holding a red jeep and red truck operated by Canton's volunteers, and a three-room school house. We stopped at the airport where we had arrived early in the morning, and saw facilities for the American, British and Canadian airliners that make regular stops on Canton. Under the Condominium agreement both Britain and the United States have equal rights to island facilities.

We stopped at the Evans home, a frame house similar to the other living quarters provided by the CAA for their personnel. Marilee, Bill's charming wife, introduced us to their four husky sons, ages eight to two, and their three-month-old daughter, Nancy, and then showed us around their fenced-in yard carpeted in white coral sand, dazzling bright at midday. There is little rainfall on Canton Island – 20 inches – and fresh water derived from distilling sea water is too scarce to attempt to grow grass, for the intense equatorial sun would soon burn it. But Marilee and Bill have managed with great care to successfully raise such colorful flowers as poinsettias, lilies and morning glories. Beyond the back yard of the little community stretches the peaceful lagoon. Here is found the true beauty of the coral atoll – the deep clear waters continually changing from greens to blues according to rising and lowering of the tide, and offering year-round fishing, boating and skin diving.

With average temperatures of 85°, Canton residents enjoy the wonderful outdoor life and everyone soon acquires a healthy tan. Of course, the situation is ideal for youngsters who love going barefooted. Many children can't remember any other life except on Canton and will undoubtedly have an adjustment problem when they come back to the States.

Usually the trade winds keep Canton comfortably cool, but the morning breeze had stopped and the air was absolutely still. We were able to escape the heat during the noon hour by lunching in the Evans' home where two native lads helped Marilee prepare and serve the meal and later do the dishes. Many Polynesian people from the Gilbert and Ellice Islands have come to Canton to make their living as domestics doing such jobs as ironing, washing, cooking, and baby sitting.

We wanted to photograph some of Canton's interesting bird life, so with Bill as guide we traveled over the rough coral roads toward the southeastern end of the island. Along the way were little bands of golden plovers, turnstones, wandering tattlers and bristle-thighed curlews. Canton's shore birds are transients spending their holiday in the Pacific. They summer in Alaska, their nesting grounds, and then journey southward across the Equator as far as New Zealand to miss the winter of the Northern Hemisphere. Of the migrants, the turnstones were most difficult to see as they stood motionless. One usually thinks of the Pacific golden plovers, those long distance fliers from arctic Alaska, and the other shore birds as being birds of the water's edge but those we saw on Canton were on the hot flats near the lagoon and we were interested to see that the plovers were feeding on lizards.

Stopping along the shores of the lagoon, we were intrigued by the myriads of small crabs upon the sands. When I approached, they disappeared like magic and made a good movie sequence. Either alarmed by the sound or vibration of my approaching steps, the crabs literally dropped from sight into their sand holes; their movements were so quick that on the screen it seems as though the action had been speeded up. They are there and then they aren't.

About two miles below the airfield we began to see large flocks of gray-backed terns rising from the ground and settling again. We ran the car off the road, heading across the sandy coral rock terrain toward a nesting colony. Thousands took to the air with shrieking cries, momentarily disturbed as our approaching car invaded their privacy. Quickly we set up our camera equipment, then sat motionless waiting for the birds to settle. The barren flat areas stretching from the seashore to the lagoon were massed with the gray-backs and among them were about twelve pairs of sooty terns. The nesting birds were unwilling to stay away long and soon landed, each onto its well camouflaged egg or small young in a poorly constructed nest of a few loose stones. Both gray-backs and sooty terns proved tame, allowing us to photograph within a few feet.

There were five species of terns on Canton. On the south side of the island we saw a dozen or more black noddy terns nesting in dead Cordia branches. Their bulky nests each held a single white egg or a downy black chick. The large brown noddy was nesting upon the ground in little isolated communities, and the white or fairy tern in the low shrubs. The latter is the most beautiful and graceful of the Pacific island birds found on Canton, I believe, and easily identified by its pure white dress. It is unique among terns in that it makes no nest of any kind but lays a single egg almost anywhere – on an outstretched limb, on a piece of coral or an old log. How the bird manages to balance the egg is a mystery. Of course there are accidents sometimes, but usually the egg is hatched and somehow the youngster manages to keep its precarious position.

We carried on a little experiment with the fairy tern to prove that birds are creatures of instinct. We flushed her from her so-called nest, then removed the egg, replacing it with a piece of coral rock of similar size. When the adult returned to the nest site she went directly to her presumed egg. Unconcerned, she attempted to maneuver into a comfortable position on the rock and then settled down. We felt that if it

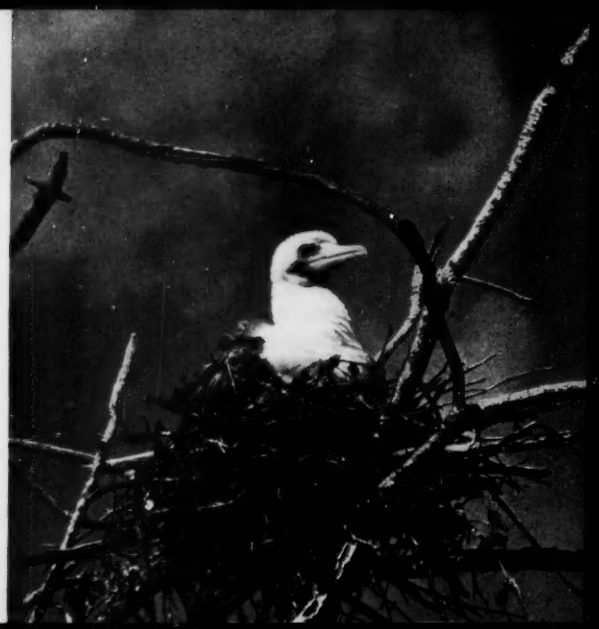
hatched, the youngster would be a hard boiled chick, so after pictures were made her own egg was returned. Whether quietly perched or inquisitively sailing overhead, the snowy-plumaged tern against the blue sky is a wonderful subject for color photography.

Further down the road we came to a colony of the large conspicuous Pacific man-o'-war birds resting in low bushes, fearless fellows who did not mind our presence in the least. Considering their weight, the man-o'-wars have the longest wings of any birds; however, their legs and feet are so small in contrast to their bodies that they have difficulty rising from level ground or water. The males – smaller than the females – had red gular sacs that they inflated like toy balloons and from a distance they looked like flowers in the trees. There was a constant going and coming of the long-winged birds; some dropping down to nests with hooked beaks filled with nesting material which they had plundered from unwary neighbors, and others rising and sailing away into the wind. We had no difficulty in securing pictures of the white-breasted females or the dark males as they sat upon their nests, each one protecting a single white egg, or a small young.

Nesting in the same community with the man-o'-wars were three species of boobies; the brown, the blue-faced, and the red-footed, the latter having characteristic red feet. North of the Equator the plumage of the red-footed is all white except for blackish primaries, but on Canton they have dark wings and back with white heads, neck and underparts. The red-footed is the only one of the trio that nests in the trees. It has only one egg, whereas the other two species have two or three chalky eggs and nest on the ground. Only one of the two naked young is reared, however, and it must be carefully protected by the parent from the sun until its white down appears. The brown boobies were often seen diving arrow-like into the lagoon water but they were uncommon on land and we found only one nest, the adults being so wild that we had difficulty getting near them. The large blue-faced, on the other hand, were obliging and allowed us to approach closely to obtain pictures. Boobies are expert fishermen, going far out to sea to catch their food. En route home one is often waylaid by a marauding man-o'-war which seizes him by the tail, upending him, causing the startled booby to disgorge the load of fish, the plunder being caught by the robber in mid air.

During our week on Canton, we made many trips to the bird colonies observing the various species of nesting sea birds. The red-tailed tropic-birds, handsome fellows with pink-white plumage and long red tail spikes, were conspicuous. Back in the 1800's they were used as carrier pigeons by the natives on the Phoenix Islands. The birds were taken in boxes to other islands where messages were tied to their legs and when the birds were liberated, they would promptly return to their nest sites. Tropic-birds were particularly beautiful when groups of a half dozen or more

A Gilbert Islands boy and one of Canton Island's thousands of birds —a young Pacific man-o'-war—eye each other, both apparently agreed on a standoff. (Muriel E. Bailey)



← North of the Equator, the red-footed booby is all white except for blackish primaries, but on Canton Island, it has dark wings and back.

↓ The gentle Phoenix Island petrel, a relative of the temperamental shearwater, is a common sight on the atoll.

(BELOW) A wedge-tailed shearwater "at home" in its burrow. Nocturnal sea birds, the wedge-tails come ashore during breeding season and establish their nests in tunnels in the sand dunes of the island.

↑ Two benign-looking red-tailed tropic birds tucked away in the shadow of a coral ledge, their favorite nesting place.

→ More proud of its profile than worried about its young, a blue-faced booby has little fear of the camera.

(UPPER LEFT) One of the most beautiful and graceful Pacific island birds on Canton, the white or fairy tern nests in the low shrubs, laying its eggs on a limb, a piece of coral or an old log, whichever is handy.

With his built-in "toy balloon" — a red gular sac — inflated, the male Pacific man-o'-war bird is a conspicuous resident of Canton Island.

One of five species of terns on Canton, a sooty tern sticks to its nest of rocks, apparently ignoring the photographer.

The large brown or common noddy nests upon the ground in little isolated communities.

sailed overhead against the blue equatorial sky. They put on aerial displays, drifting forward and back, sometimes hovering motionless in mid air and all the while calling noisily to their mates. These courtship antics usually took place about midday and we could discover their nest sites when the performers dropped to their mates. Fortunately, we had electronic flash equipment, making it relatively easy to take portraits of the nesting pairs in the dark shadows of the coral ledges, or in the heavy undergrowth of the scaevola bushes. Nature has endowed them with razor-sharp beaks to defend themselves against the vicious hermit crabs that are a constant threat to the young birds. We saw many tiny babies being preyed upon by these killers, and each time we threw the crabs as far from the nest as possible. But these marauders seem indestructible and all ground-nesting birds are susceptible to their thousands.

Most of the land surface of Canton is of coral rubble, but on the southeastern end there are a few sand dune areas that are honey-combed with burrows. At first I thought these holes were made by the Polynesian rats but then I realized they were too large. Instead they are nesting places of the wedge-tailed shearwaters, nocturnal sea-birds which come ashore during the breeding season. During daylight hours there is little evidence of these long-winged relatives of the albatrosses, except the scuffed entrances to their tunnels. We excavated several from five to ten feet long, and found a slate-gray adult incubating a single white egg at the end of each – birds that protested with raucous voices and sharp claws. Their mates fly over the open ocean during the day and do not return until darkness settles over the land. Then they swarm through the night sky in unbelievable numbers. They get their name "shearwater" from the habit of shearing close to the surface of the ocean as they fly swiftly along. Often they are on nesting islands in enormous numbers, and have such caterwauling notes that they have been named the "Wailing Birds."

A near relative nesting in shorter tunnels or on the surface of the ground under vegetation is the more gentle Phoenix Island petrel, a white-breasted, brown-backed bird slightly smaller than the wedge-tail. They fly in the late afternoon, and on one early evening excursion to the end of the island we saw many as they curved over the dunes on fast-moving wings – their eerie far-reaching voices being heard above the pounding of the surf on the nearby beach. As night settled over the atoll, the wedge-tails came from their burrows and sat at the entrances, and swarms of their mates which had been at sea came hurtling through the darkness in such numbers that we marveled that so many birds could dart through the sky without collisions.

Marine life is exceedingly abundant in the warm waters. Corals, sea urchins, sea cucumbers (beche de mer), and colorful sea shells abound in addition to the red hermit crabs which crawl over the island. There are smaller, harmless hermit crabs which we found exceedingly numerous. On my first walk along the wave-beaten shores of Canton Island, I had gathered the prettiest shells I could find, placing them in my side pocket, and later in the day when I wanted to look over my new collection I reached for a handful. They were crawling! I quickly threw the shells to the ground and watched in amazement as they mysteriously moved about. Then I discovered the funny little creatures, small white crabs, that were walking around with their houses on their back. Every shell I had gathered was the adopted home of a hermit crab. Their housing situation was a simple one for when one outgrew its shell, all it had to do was to find another of suitable size.

The people of the island are most hospitable. They see planes coming in at regular intervals but rarely do passengers stop, so when visitors appear, everyone gathers. On our first night on the island we were the guests of honor at a fish fry given near the hotel under the open starry sky. There were about fifty guests to consume the large steaks of wahoo, a marvelous fighting fish which abounds in the tropical waters.

It was there that I met Bill Dirk, an enthusiastic ham radio operator who pursues an exciting and satisfying hobby of talking to people all over the world by short wave. Friendships, understanding, and much good will are made through these ambassadors who spend long hours in the night talking to other hams halfway around the globe. Bill, an expert in this technical pastime, willingly agreed to attempt a call to my husband in Denver. The clock on Canton pointed past 8:00 P.M. which meant 1:00 A.M. at home. At such an hour it was not surprising that Bill failed to make a Denver contact. Then he sought a reply from anyone stateside. Immediately an answer came through from Seattle. I was much excited when this operator offered to put in a long distance phone call to Denver, thus via the magic of short wave and telephone, I talked to Jim some 6,000 miles away. The following two evenings Bill got Denver directly.

Everyone on Canton is an ardent fisherman for there is some of the finest deep-sea fishing to be found in tropical waters. One morning I joined Dick Slater and other Pan American personnel long before the sun was up to have my first try at deep-sea fishing. The launch skirted through the passageway from the lagoon into the sea as the first delicate morning lights appeared on the horizon. I was given one of the two fishing chairs in the stern of the boat and we trolled through the rolling water parallel to the shore. Suddenly there was a yank on my line as a beautiful wahoo three feet long made a series of leaps as he took line from the whirring reel. Desperately I tried to heed advice spilling from eager companions – then the leader broke and I was

glad to ease tired arms before attempting to hook another.

The beautiful lagoon on Canton is a paradise of picturesque coral and tropical fishes. One of the delights was swimming in the mirrored waters with a face mask to study the coral formations and other sea life. Fish are so numerous that commercial seining has become a lucrative business for some of the islanders, one such person being Joe Mederios, a Portuguese who had established a fishing station 2,000 miles from his nearest market. One of his favorite spots was just at the entrance of the channel across from the rusting hulk of the old palatial ocean liner the *President Taylor* which was wrecked on the shores of Canton during the war years. With the outgoing tide there would be great migrations of fish – *awa* running from 5 to 30 pounds each, *oio* from 12 to 16, and the prized *ulua* which ranged up to 70 pounds. Mullet were exceedingly common, and there were the parrot fishes with coral-crushing jaws.

We accompanied Joe late one afternoon to watch the proceedings. The swift current of the lowering tide carried the fish through the channel entrance into the sea where they turned to the right into the line of surf that washed the shore edges. It was necessary for the native boys to work quickly as they took the seine several hundred feet from the mouth of the lagoon and waded into the ocean until the waves lifted them from their feet. They stretched their net parallel to shore, then started toward land, the end boys going more quickly while helpers from the shore came running and splashing into the shallow water to frighten the fish into the net that was being dragged into a circle. The fish were trapped, many escaping by jumping over the top, but the majority were caught by their gill covers. On this first haul the happy boys caught about 300 pounds of mullet, each one weighing close to a pound. They were dressed, chilled, packed in ice, and placed aboard the midnight northbound plane. Less than 24 hours after being caught, the fish were marketed and served on tables in Honolulu nearly 2,000 miles away. Pan American Airways has made commercial fishing possible. The cost for air freight at that time was 15 cents a pound and the fish sold in Honolulu for 65 cents a pound. At the time of our visit Joe had marketed 61 thousand pounds in five months, at considerable profit for fishermen and airlines.

And so the days on Canton rolled along. We had continuously cloud-flecked skies with cool trades ruffling the placid waters of the lagoon – ideal weather for our brief sojourn upon the little equatorial island. We had learned something of the habits of the birds and other animal life; we became acquainted with many fine people doing an excellent work in a far-off part of the world, and it was with real regret that we finally started our journey homeward.

In the firm grasp of a Gilbert Islands boy, a large wahoo is destined to become the main course at a Canton fish fry. The wahoo, a marvelous fighting fish, abounds in the tropical waters.

ALGA FARMS

Tom Riley

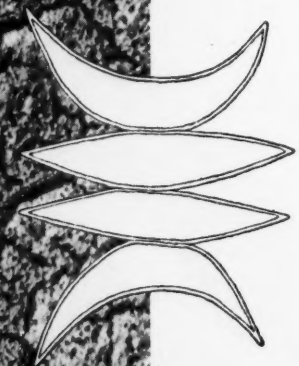
MUNICIPAL SEWAGE, with its attendant disposal problems, has plagued man since he first began to gather in cities centuries ago. Today evidence indicates the sewage is being turned into a valuable, commercial product, thanks to a new technique developed by a team of University of California scientists.

The scientists' process, which began in the laboratory and small pilot plant stage, is now being carried out on a larger scale in a small California city's municipal sewage plant. Using their system, the scientists are converting the rich, waste nutrients of raw organic sewage into a potentially commercial livestock feed.

The necessity for elaborate systems to dispose of city waste and sewage has long irked man, especially since modern studies reveal that man hardly alters either the bulk or the nutrient value of the tons upon tons of food he consumes daily. Because of this, a quantity of organic waste roughly equal to that shipped in from croplands must be trucked out again from the cities and disposed of in some acceptable fashion and more than 90 per cent of the nutrient value of this food waste is lost forever.

Dr. Harold B. Gotaas, former director of the University of California's Sanitary Engineering Laboratory, didn't like this situation and he determined to do something about it. With his associates, Dr. Clarence G. Golueke, research biologist, and Dr. William J. Oswald, sanitary engineer, he concluded that it was possible and highly desirable to find some way to tap this enormous source of food energy.

After careful study, the scientists found the wasted nutrients could be salvaged most easily by means of nature's own extraction system, photosynthesis, a system which operates on free solar energy. At the same time, the scientists decided the single-celled alga plant would work to convert



Alga farms may provide a rich new livestock food resource.

Drying algae make a curious mosaic-like pattern. Inset drawing is of a variety of *Schenedesmus*, one of two types of algae used in the alga farms experiments.

PHOTOS BY BILL CROUCH

➔ **Dr. Gotaas holds beaker containing algae, used in experiments to determine maximum photosynthetic efficiency possible in alga farms.**

the valuable product extracted by photosynthesis into usable food.

For more than four years, the three scientists have carried on their research at the university's Richmond Engineering Field Station on the northeastern shores of San Francisco Bay. Here, pilot "alga farms" were constructed and while the nutrients were trapped in algal cells grown in ponds of Richmond city sewage, the scientists made careful measurements of the efficiency of the process.

The Richmond tests proved so successful that Dr. Gotaas and his colleagues this year established an alga farm as part of the sewage treatment plant in Concord, California. (Population: 7,000.)

All of Concord's sewage is being pumped into a receiving tank at the treatment plant. Here, all coarse and heavy particles are broken down and the material is then transferred into a shallow, open pond covering nearly two acres of ground and ranging in depth from 12 to 18 inches.

To speed up the process, the scientists seeded the pond when it was first put into operation. Two types of algae were used: *Chlorella spp.* and *Schenedesmus spp.* However, explains Dr. Golueke, seeding is not absolutely necessary. These same algal forms will eventually take hold and grow in the pond by natural means.

In the pond, the algae live in close harmony with a variety of bacteria which also colonize by natural means. The bacteria decompose and break down the organic materials in the sewage effluent. In the process, the bacteria give off ammonia, carbon dioxide and other nutrients which the alga plants thrive on.

Then, through that remarkable "manufacturing" process known as photosynthesis, the algae convert these chemicals into cell protein and carbohydrates. At the same time, they give off large quantities of oxygen which is in constant demand by the bacteria.

This biological cycle will continue to operate in perfect balance as long as there are adequate amounts of organic material in the water environment, Dr. Golueke says.

Another advantage of the alga farm is the complete absence of odor. Dr. Golueke says this is because of the tremendous amount of oxygen which constantly saturates the open pond. Thus it is possible to locate an alga farm on any available land without running the risk of creating a nuisance or a public health hazard.

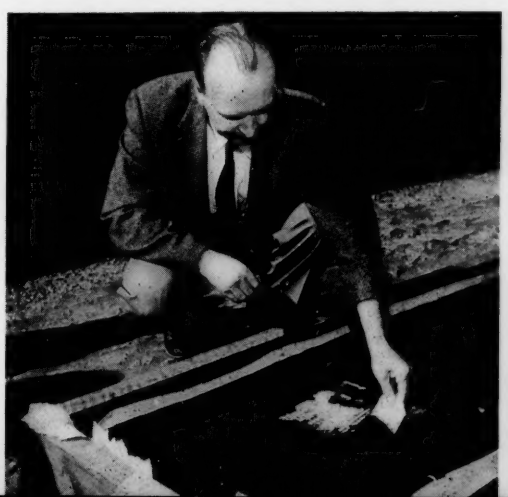
The efficiency of the alga farm as a growing site for livestock feed has many important implications. At Concord, the scientists predict they will produce 35 to 40 dry-tons of algae per acre of pond annually. Dr. Gotaas claims this is equivalent to 22 tons of pure protein feed.

Compared with the annual production of between two and three tenths of a ton of protein – including livestock – per acre on the average American farm, it is obvious alga farming offers fabulous possibilities.

Companion studies on the Davis campus of the University of California – the states' major agricultural research center – has proven algae make nutritious and remarkable livestock feed. As feed – dried, pasteurized and packaged – algae resemble, in both taste and appearance, green grapenut flakes. The Davis scientists report the feed contains about 50 per cent pure protein, and minerals, carbohydrates and fats make up the remaining 50 per cent. All of these are essentials in animal diets.

A measure of its commercial worth can be roughly calculated, explains Dr. Gotaas, from the amount of protein in animal feed now on the market. The American farmer today pays about $2 per ton for livestock feed containing not quite one per cent protein. On this basis, algae as feed – containing 50 times as much protein – might bring as much as $100 per ton. Understandably, several feed manufacturers are watching the developments at the University of California.

The Davis researchers have recommended that the processed algae be cut one part to three of roughage because of its richness. Other investiga-



➔ **Dr. Golueke examines drying alga plants in test rack at the University of California's Richmond Field Station.**

tors claim that algae processed into food compare nutritionally with fishmeal, generally considered one of the richest forms of animal feed.

Livestock feed is not all that scientists hope to recover from waste sewage. Dr. Gotaas claims the Concord farm will be able to recover safely more than 200,000 gallons of water daily for industrial or agricultural uses. In thirsty California, the water recovery aspect of the Concord alga farm holds nearly as much interest as the livestock aspect.

About 90 per cent of all sewage is water. Generally, it is disposed of through expensive but limited processing methods. Some California industries are paying as much as $125 per million gallons of water, used solely for cooling purposes. Water extracted from partially treated sewage in the San Francisco Bay Area and not used by industry is now discarded in potentially dangerous quantities into San Francisco Bay, Dr. Oswald claims.

With the algal process, the scientists at Concord estimate total processing costs – including recovery of both nutrients and water – will run less than $100 per million gallons of effluent.

The cost of waste water treatment now generally employed by cities varies widely depending upon disposal requirements of the area. Dr. Gotaas says that Madison, Wisconsin, pays up to $125 per million gallons of sewage to remove pollutants before piping the processed water into its beautiful neighboring lakes. This processing is fairly complete but, as the figures show, quite costly.

Despite the efficiency of the Madison process, much of the nitrogen and phosphorous nutrients in the sewage are not affected by the processing plants. These materials are passed into the lakes where they become rich food for a luxurious and unwanted algal growth. Because of political implications of this situation, Madison city fathers are now faced with public pressure to construct still more expensive processing plants.

Meanwhile, the University of California scientists are seeking new by-products and even more efficient techniques for operating their alga farm. At present, the algae are "clumped" together by adding alum to "settling out" tanks. The reclaimed water is then wrung out by centrifugation in machinery similar to a dairyman's milk separator.

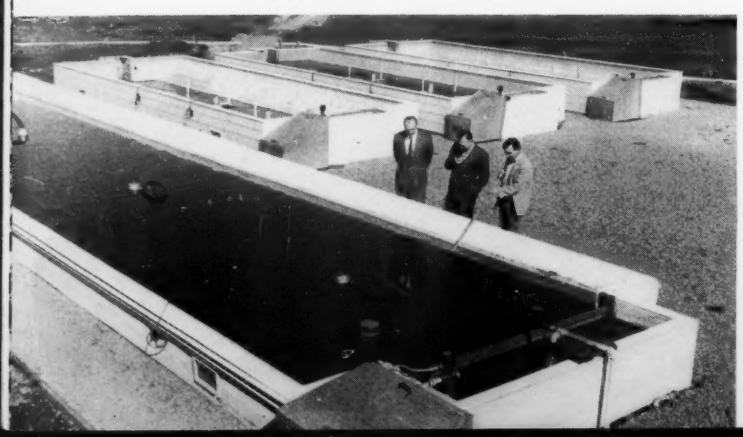
The oxygen generated in the pond by the algae is wrung from the liquids in the centrifuge and Dr. Oswald says there is an interesting possibility of recovering this wasted free oxygen in industrial quantities. He says a southern California firm now operates a costly process to recover oxygen – to be used as a rocket fuel – from the atmosphere. The amount of pure oxygen escaping from the open pond and from the centrifuge is a great deal more than the 20 per cent component in the air we breathe, Dr. Oswald points out.

Perhaps even more important, the most pressing need for the benefits of the algal processing systems is in those regions of the world where meteorological conditions are most ideal for the alga farm's optimum performance. The raw materials needed to operate the farm occur in putrid abundance across the sun-drenched, practically-sewerless and underdeveloped stretches of Asia and Africa.

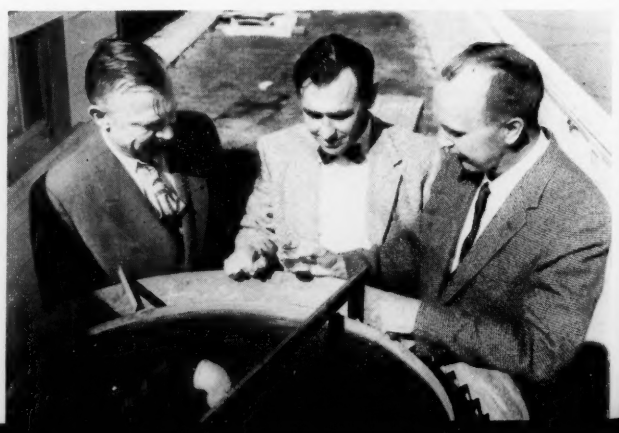
Many leaders in those areas are carefully observing the pioneering trials here. The University of California investigators receive correspondence regarding their work daily from all over the world.

It may develop that the dour, eighteenth-century predictions of Thomas Malthus, the English parson-economist, are delayed by many centuries as a result of the development of this unusual "natural resource." In this race against the Malthusian forecast – that overpopulation and lack of food will combine to bring mankind's end – science appears ready to win another lap.

(FROM LEFT) **Drs. Golueke, Gotaas and Oswald at pilot alga farm at Richmond Field Station. Large pond is used for quantitative studies, smaller ones for various control experiments.**



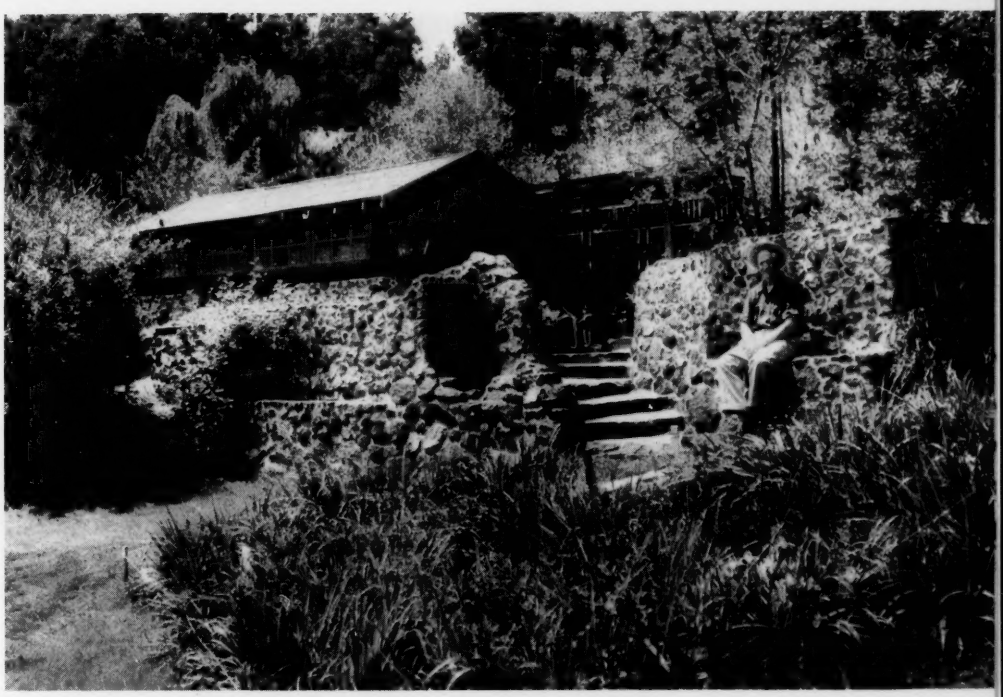
Alga farmers Gotaas, Oswald and Golueke inspect separation container where large particles of organic sewage are settled out of the constant flow of raw materials.



James Roof:

MOUNTAIN PLANT EXPLORER

Philip Ferry



Photos by James MacBride

A CALIFORNIA plant pathologist writing a book on the cypresses of the West Coast lamented to an associate that he could not bring his book to completion because he had not succeeded in collecting a specimen of the rare Guadalupe cypress known to grow on the Pacific Coast.

"Why, there's a kid in San Francisco who has that species growing in his backyard," the associate said.

The learned doctor was inclined to pass this off as a joke but, finally convinced that his friend was serious, he decided to investigate the doubtful fact of a mere boy possessing a rare botanical item which no expert included in his collection. He sought out the youngster and found to his astonishment and delight that the ten-year old was indeed raising seedlings of the elusive species in a makeshift nursery out behind the woodshed. It took two hours of diplomatic and persuasive talking before the drooling doctor succeeded in convincing the reluctant youngster that he would be making a major contribution to science by parting with three or four seedlings of *Cupresses guadalupensis*. As a result, if you read Dr. Willis Wagner's treatise on the West Coast cypresses you will see that he credits Jimmie Roof with providing the specimens that enabled him to complete that work.

Today, some three decades after the above-mentioned incident, botanists still seek out James Roof and try to talk him out of some rare tree or shrub he has in captivity but which has, it seems, eluded every other plant collector. Now they find Roof director of the East Bay Regional Parks Botanic Garden in Tilden Park, near Berkeley, California. One of those lucky fellows who managed to build a boyhood hobby into a profession, Roof the horticulturist is more a dedicated plant explorer than ever. In his exploring he has collected plant species from all seven life zones of California's flora—from cacti of the Lower Sonoran zone to alpines of the high mountain regions. His first love is trees, however, and his proudest exhibits are the mountain species he has transplanted to his sea level plots.

Roof is a heavy, muscular down-to-earth fellow who is happiest when grappling with nature, either digging in his gardens, tramping miles through the wilderness, or scaling mountain slopes. He is an indefatigable outdoorsman and wears out any and all companions who are rash enough to be talked into joining him on one of his field expeditions. He has made dozens of collecting trips into the Sierra Nevada, driving anywhere from 200 to 500 miles in quest of a colony of plants, perhaps returning again and again to the same area to continue the search for a lone specimen that has escaped his trained eye. A favorite collecting locale is the Scott, Marble, and Trinity mountains of northern California, some 300 miles from his home base in

James Roof, director of the East Bay Regional Parks Botanic Garden in Tilden Park near Berkeley, California, is rarely to be seen sitting this quietly. In the background is the Regional Park Nursery, where many of the garden's rare trees are coddled.

Berkeley. It took a long pack trip into the Marble Mountains before he succeeded in obtaining specimens of silver fir *(Abies amabilis)* and weeping spruce, the latter very limited in range. He paid three visits in as many years to the higher slopes of California's White Mountains, an isolated range on the eastern border of the state, before he succeeded in collecting some high-altitude tree species he particularly desired. The Navy has a cosmic ray research station at the 12,000-foot level on the mountain and a road of sorts to this laboratory. Roof has combed the upper reaches of the mountain in his search for transportable specimens of bristlecone and limber pines. The White Mountain expedition turned out to be the most hazardous he has ever undertaken, the search for the two pines being a prolonged battle with nature and the elements. On his first try his pickup truck could not negotiate the mountain's steep grades. He returned with another truck and reached the 12,000-foot level, only to be driven off by a blizzard which theatened to trap Roof and his assistant, Robert Owen. Roof says snow rimmed Owen's face until he looked like "Admiral Byrd in the Antarctic." When Owen decided to give up the hunt and head back to the truck, which had been parked just below the snowline, Roof elected to stay out the storm and continue the search for the specimens. When the snow drifted three feet in a matter of minutes, Roof concluded that perhaps his enthusiasm was outstrip-

ping his judgment and he fought his way back to the truck. A third visit brought success and today the bristlecone and limber pines occupy a place of honor at Tilden Park.

These pines do not thrive naturally below 9,000 feet, yet Roof has them flourishing close to sea level, and though experienced woodsmen may go a lifetime without setting eyes on these two species in their native habitats, the casual visitor may view them at Tilden Park.

All of this plant pioneering has made Roof's collection one of the most comprehensive roundups of native flora and silva ever brought together at one place in this country. So far as he knows, his is the only public garden whose main objective is the inclusion in one master plan of a typical sampling of a state's native flora arranged by zones.

The Botanic garden is a rather small layout of only eight acres set in a bowl-like depression in Tilden Park, the latter a recreational unit of the East Bay Regional Parks District. Roof has entirely reclaimed a bramble-grown swale and transformed it into a well tended sward of green lawns, flower-bordered walks, and quiet glens where one may contemplate the handiwork of a master gardener. He has utilized the space so skillfully and arranged the individual settings so tastefully that he has managed to carry out his all-inclusive program without giving the appearance of crowding. Thus

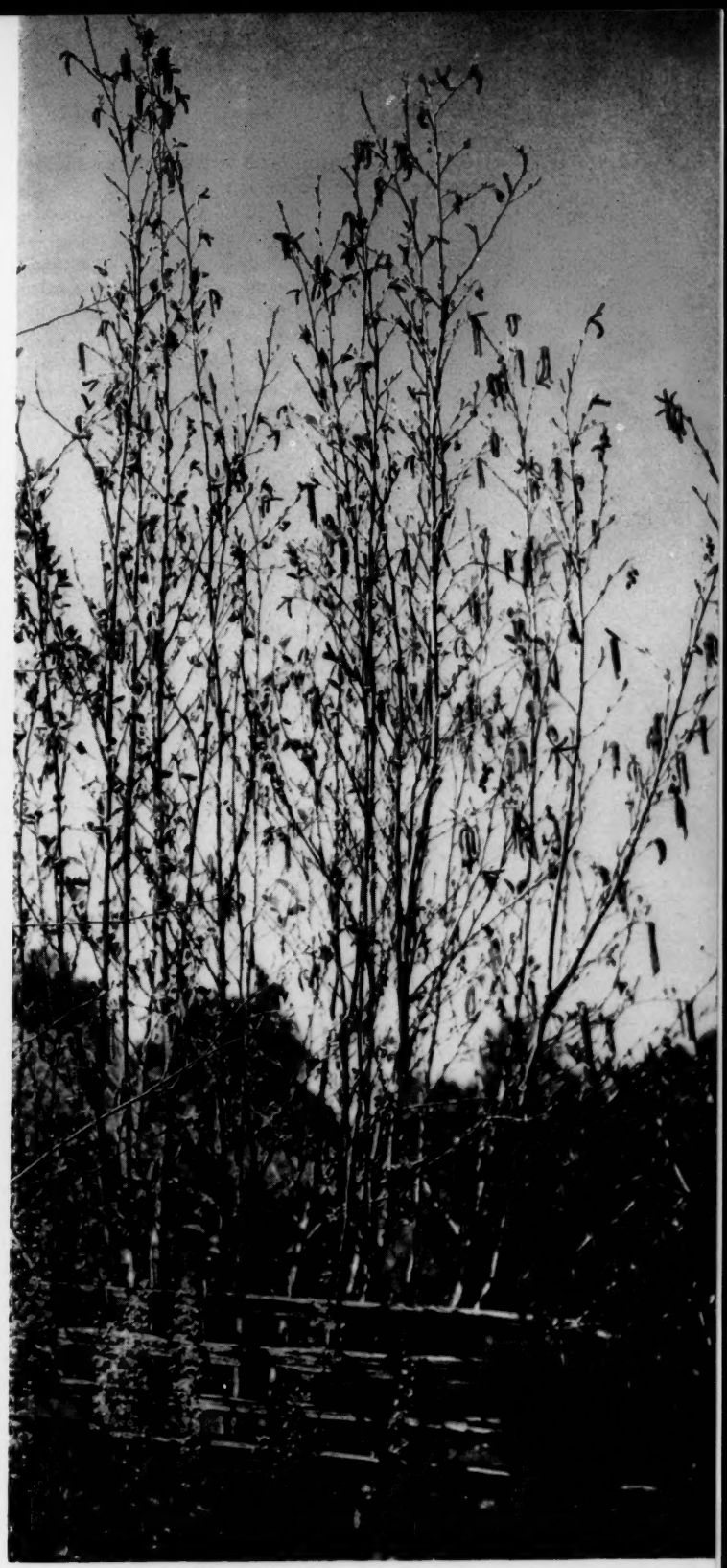
A rippled, flora-lined pool in the eight-acre Botanic Garden is a favorite spot with children, especially those who like to get their feet wet.

the garden has the serene look of a rolling estate with well manicured lawns and harmoniously arranged plant communities. Tilden Park is only a 15-minute drive from the U.S. Forest Service Experiment Station on the University of California campus at Berkeley and Roof frequently encounters botanists from both the University and the Forest Service strolling the grounds and contemplating his rarities.

Roof's whole life and energy seem channeled into his collecting, as if he felt a closer kinship to trees than to people. It is hard to get him away from the gardens at any time and absolutely impossible to do so on Saturdays, Sundays, and holidays when visitors, particularly children, are about in numbers. He wants visitors to enjoy his plants but keep hands off. An injury to one of his specimens is an injury to himself and he undoubtedly feels it more keenly than the plant does. On a busy weekend he keeps as active as a birddog shooing away would-be flower pickers. The most trying period of the year is that just preceding Christmas when he maintains what he calls the Christmas tree patrol. This is a day and night watch designed to frustrate latter day Paul Bunyans who invariably think Roof's finest conifers would make admirable Christmas trees. Since the specimens they hit upon may be irreplaceable, Roof understandably has an annual attack of pre-Christmas jitters.

To collect and maintain the plantings is not enough for Jim Roof. He must also make a showplace of the layout. With one assistant and a budget not designed to encompass such a program, he has been working for years constructing stone retaining walls, cement walks, artistic bridges, fern-bordered pools, miniature cascades, and settings which resemble the natural habitat of the growing plants. What he has made of the project is not some formal garden with clipped hedges and flower beds set out in forbidding geometrical patterns. This is a habitat arrangement of naturally associated and untamed plants and Roof keeps the setting in harmony with the plants' original habitats. The success of the project is owing in no small measure to the personal interest he takes in each individual specimen.

The Botanic Garden was a chance outgrowth of an entirely different project. The whole thing came about by accident. In 1935, Roof achieved his boyhood ambition of joining the Forest Service and was assigned to the Branch of Research at the California Forest & Range Experiment Station at Berkeley. He remained with the Forest Service until 1942 when he entered the armed forces. In that same year of 1935 the Forest Service began collecting native California plants for experimental use in erosion control tests. Roof was in the division of forest influences at the time, a section which had direct charge of the erosion control program in California. The process of collecting and testing went on for several years, during which time the Service accumulated a vast store of growing plants



Alder — here nearly dressed for spring — is one of the many varieties of trees Roof collects and brings to maturity in the Botanic Garden.

which were kept in cases, boxes, tubs, cartons, cans, and other portable containers.

It became apparent in time that here was a sweeping and mobile sampling of native flora that would make an extraordinary exhibit if it could be kept intact. A search was begun for a site where a botanic garden might be created. After careful consideration the choice fell on Tilden Park, a unit of the East Bay Regional Parks District, the joint project of seven East Bay cities. The site had many obvious natural advantages. It was well watered by Wildcat Creek which runs through the middle of the basin; the lay of the ground—facing all points of the compass—would favor plants of diverse needs. And being midway in the state, the park could grow most West Coast plant species, something not possible at either extremity of elongated California.

The botanic garden was a three-pronged coöperative venture: the park authorities provided the site, the Forest Service donated the plants, and the WPA furnished the labor. Roof went along with the plants. At first he divided his time between the Forest Service and the botanic garden, a connection which enabled him to transfer plants at will from one project to the other. In 1946 after four years in the Army, Roof returned to a neglected and rundown botanic garden but decided nonetheless that his future lay with the project. He has since been offered the directorship of other large gardens but chooses to stay at Tilden because the latter, with its midstate location, offers opportunities not found elsewhere. His ultimate objective, he confesses, is a highly personal one: to collect every species of California flora that will grow at Tilden Park and arrange the whole so that the public can view the display in pleasant surroundings.

The development of the site has since proved to be a model for all botanic gardens. Today Roof says proudly the garden provides something for everyone. "The forester can admire the extraordinary assemblage of trees; the botanist can observe the relationship of plants in the plant communities; the landscape architect can study landscaping with the use of native plants; while the general public, which the park authorities consider the most important element of all, can view the show as a purely esthetic spectacle."

Already the garden is noted for having many scarce items not found in any other collection—such things as rare oaks, blood currant, Alaska yellow cedar, and little known desert plants.

The last include a typical sampling of Death Valley flora. A trek to Death Valley can involve 700 miles of driving. Roof has made seven trips from a base camp in the valley into the higher reaches of the bordering Panamint Mountains to collect the small tree called mountain mahogany plus what is California's rarest plant. This latter, which answers to the tongue-twisting name of *Tetracoccus ilicifolius,* is a low-spreading, ground-hugging evergreen shrub with hollylike leaves, about two feet high and with an eight-foot spread. So far as anyone knows this is the only specimen of its kind in cultivation.

It is an interesting fact that Tilden Park lacks species often found in other gardens. The reason for this seemingly contradictory state of affairs is that Roof is inclined to pass up the more common species in favor of rarities not likely to be seen in other collections. He is ever on the alert for scarce items that will enable him to round out his collection and always has several unfulfilled field expeditions in mind. It was this quality of alertness that enabled him to make his first important boyhood acquisition, namely, that of the Guadalupe cypress: A California Academy of Sciences botanic expedition had collected specimens of the tree on Guadalupe Island, off the southern coast of California, and planted the trees in Golden Gate Park. The alert youngster collected seeds from these trees—something apparently nobody else had thought to do—and planted them in his crude nursery. It was seedlings from these plantings that the budding plant explorer presented to Dr. Willis Wagner, historian of the cypresses.

His rarest and proudest item is the whitebark pine, *Pinus albicaulis,* said to be impossible to cultivate at such a low altitude. Starting in 1935 he made 32 trial plantations of this timberline species but lost them all. The tree simply would not respond to cultivation. In 1948 he gathered a trial batch of a dozen little trees at Tioga Pass, nearly 10,000 feet elevation, and planted them in a bed of andesite, a crumbly fractured stone common in the vicinity of Tilden Park. By choosing well drained ground and a northern exposure and by being careful not to water the trees excessively (he nurses the trees himself, not permitting anyone else to tend them), he has managed to bring the trees to comparative maturity.

His own personal favorite is the beautiful conical Santa Lucia fir, the world's rarest fir tree and a species sought by arboretums around the world. The entire range of this tree is only thirty-two miles in the Santa Lucia mountains of California's lower Coast Range, and is not continuous in that range. Roof collected seeds of Santa Lucia fir for six or seven years only to lose them to a parasitic wasp which feeds on the seeds of this fir. He finally succeeded in raising a flourishing specimen. When he showed me the flourishing eight-foot specimen he considers his prize acquisition, he greeted the tree like a respected friend, touching its branches gently and murmuring, "Hello, old fellow."

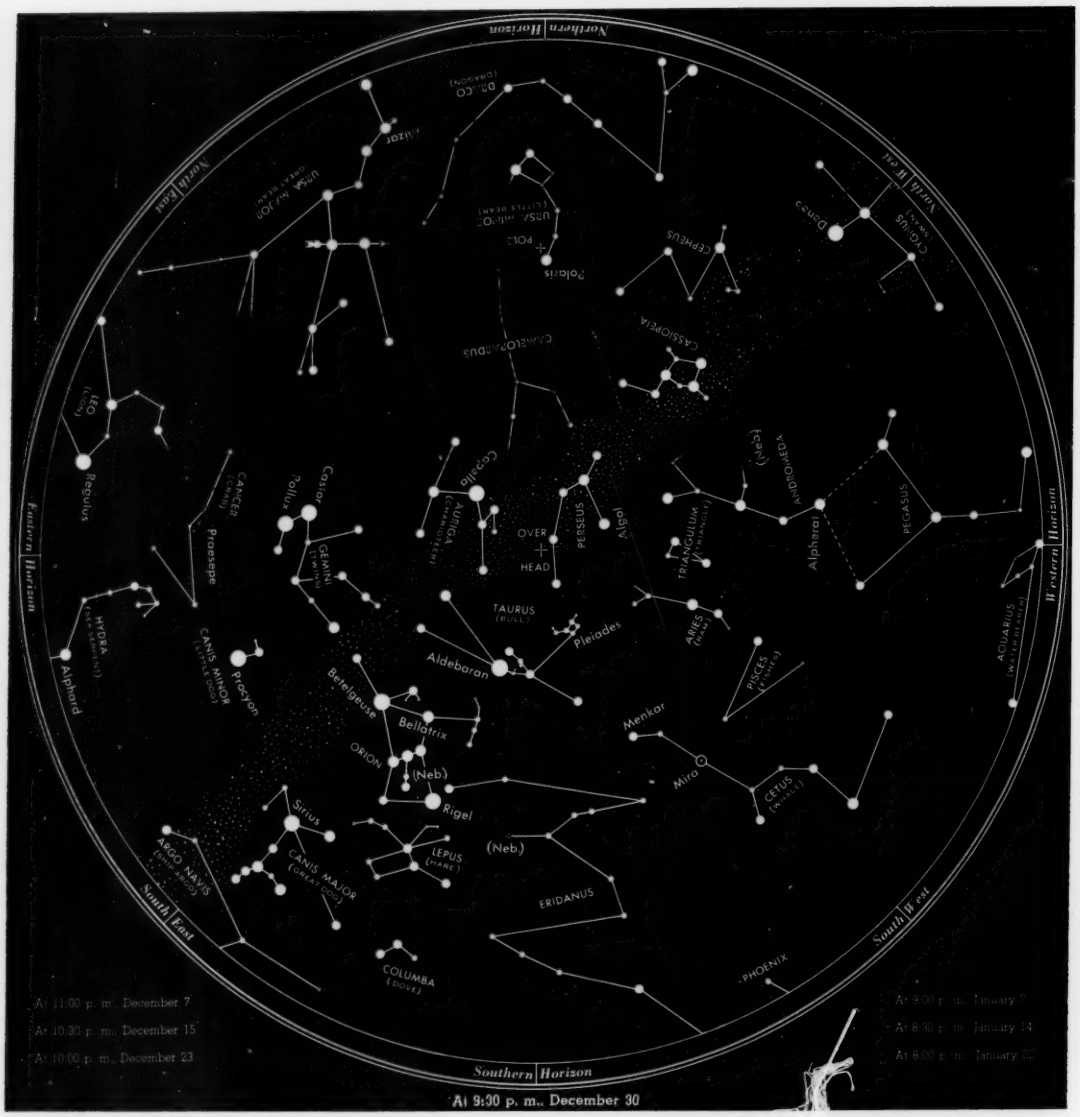
His most uncompromisingly obstinate subject has been the chinquapin. So far as Roof knows, nobody has succeeded in domesticating this tree-like shrub, a member of the chestnut family. Roof has been trying since boyhood but without success. He continues to experiment with the shrub, not because he is interested in adding it to his collection (actually, he is not) but

because it represents a problem nobody else has licked, a condition that brings out something in Roof. He says: "The rarest tree in a collection is not necessarily the one which is most difficult to collect. Sometimes it is one of our common wild species, many of which do not respond to cultivation. This applies to the chinquapin. Although this shrub grows wild all around the Bay Area, I have yet to bring one to maturity at Tilden Park."

His most genuinely disappointing project to date has been his hassel with the Northern foxtail pine. At present he is coddling a pair of seedlings in a lath nursery but hesitates to place the trees out of doors where they would have to fend for themselves. He collected these small trees in the Siskiyou Mountains of far northern California. Although essentially the same tree as *Pinus balfouriana* of the Sierra Nevada and the Scott Mountains of northwestern California, the Siskiyou form seems to differ physiologically from any other conifer in his collection. Although he has not succeeded in bringing a Northern foxtail pine to maturity, this is a tree he admires greatly and he hopefully continues his experiments. The determined gleam in his blue eyes as he contemplates the seedlings in his nursery is probably indicative enough of what their outcome will be.

Roof collects plant species from all seven life zones of California's flora, but his first love is trees and this view of the Botanic Garden at least partially explains why.

THE SKY, **THE SATELLITE,** *THE STAR*



INCLUDED in this issue is a map of the Winter Sky. To use this map when facing North, hold the map vertically with North at the bottom. When facing West, turn the map so that West is on the bottom, *et cetera.*

Orion the Hunter dominates the Winter Sky. He is followed by his faithful hunting dogs, *Canis Major* and *Canis Minor.* The brightest star in the sky, Sirius, will sparkle its way across this season's sky as it has done for centuries. Sirius is also called the Dog Star, for it marks the nose of the Big Dog, *Canis Major.* Sirius (magnitude −1.44) is one of the nearest stars. It is about fifty trillion miles distant. Light traveling at the speed of 186,000 miles per second takes some 8½ years to reach us from that star. If Sirius were placed where our sun is, our oceans would boil away. Sirius is some thirty times brighter than our sun.

If you have binoculars or a telescope be sure to look at Orion's sword. Just below the three stars that form Orion's belt you will see what looks like a fuzzy star. This is the famed Orion Nebula, a cloud of gas that is possibly the birthplace of stars. Photographs of the nebula taken by large telescopes reveal dark patches called globules; these may be the beginnings of stars.

Our view of the universe today is far different from man's early concept of the sky. To the Egyptians of

several thousands of years ago, the sky was a big tent stretched across the earth from lofty mountain tops. The stars were thought to be lanterns hung from the tent. As the centuries went by, some Greek philosophers suggested that the sky was a large crystal sphere turning about the earth; the stars were imagined to be jewels embedded in the sphere.

This crystal sphere idea was shattered by Galileo who surveyed the heavens with his little "Optic tube" back in 1610. He noted that the planets were worlds moving around the sun much as the earth is. The stars, he realized, were distant suns shining from the depths of space. Giant telescopes today reveal the vast multitudes of stars that form the Milky Way and more distant Milky Way systems which we call galaxies.

The positions of the planets are not indicated on the star map. The planets are continually changing their positions (see Sky Diary). The stars are moving too, at terrific speeds, but they are so far away that they seem to remain fixed for centuries. Only powerful telescopes show that the stars are moving across the sky.

The planet Venus shines brightly above the western horizon at sunset during this Christmas season. Rather appropriately it reaches greatest brilliancy almost on Christmas Eve. It looks like a sparkling diamond in the sky some sixteen times brighter than the brightest star. Undoubtedly it will remind many of the famous Star of Bethlehem that drew the attention of the Wise Men some nineteen hundred years ago as they were led by its shining light to the place of the young Christ child.

Also not placed on our star map is the path of the Soviet satellite that has been "beeping" its way around our globe for many weeks now. The satellite traces a complicated path in the sky from day to day, so no attempt is made to include it on our map. By now "Sputnik" has lost its voice. Visual and photographic observations are necessary to keep tab on it.

This satellite and others to be launched by our own country are symbolic of a new era for science and technology. The satellite represents man reaching into space. Up to now, man has been on the receiving end, depending upon the light from the distant stars for his information of the universe. Now he is taking actual steps into this frontier of space. Larger man-made moons will soon be launched. They will be hurled higher into the skies. Man may even set foot on the moon before the close of this century.

A few decades ago satellites and rockets were relegated by most of us to the domain of science fiction. It is evident today that space-conscious scientists were not content to leave the subject there. In man's nature an insatiable curiosity coupled with perseverance enables him to achieve seemingly impossible goals. The strides made by science and technology bear this out.

In this scientific age there is a tendency to place so much emphasis upon the physical and material that spiritual starvation is a danger in our otherwise abundant society. For man has been endowed by his creator with a spirit too. This ultimately leads man to greater accomplishments and more worthy goals.

We recognize in the satellite a symbol of man's scientific achievements. We need more than the satellite, however, we need to look beyond to see the Star. That same Star that shone over Bethlehem. It led the Wise Men of old and it can lead wise men today. For the Star symbolizes man's greatest quest, the quest for Truth.

C.F.H.

SKY DIARY

December, 1957 and January, 1958

(Pacific STANDARD Time used throughout)

Phases of the Moon

Full Moon	December 6	10:16 P.M.
Last Quarter	13	9:45 P.M.
New Moon	20	10:12 P.M.
First Quarter	28	8:52 P.M.
Full Moon	January 5	12:09 P.M.
Last Quarter	12	6:01 A.M.
New Moon	19	2:08 P.M.
First Quarter	27	6:16 P.M.

Meteor Showers

December 13-14—**Geminids:** maximum about 40 per hour on that night, with duration of 5 days around it. Radiant about overhead after midnight.

January 3-4—**Quadrantids:** maximum about 35 per hour on that night only. Look above northeastern horizon after midnight. Bright moon may interfere with observation.

The Planets

Mercury: Greatest elongation east of the sun on December 7. Visible above the western horizon for ten days around this date for about an hour after sunset. Inferior conjunction on December 25. Greatest western elongation on January 15, magnitude 0.0 and visible above the eastern horizon about 1½ hours before sunrise.

Venus: Reaches greatest brilliancy on December 23; magnitude −4.4 (16 times brighter than the brightest star). Visible above the western horizon. In conjunction with the moon on January 20 at 3:52 P.M. (separation 0°40′). Disappears from evening sky on January 28 when it reaches Inferior Conjunction.

Earth: Winter begins on December 21 at 6:49 P.M. Reaches Perihelion (nearest sun) on January 3 (distance from sun: 91,500,000 miles).

Mars: Around magnitude + 1.7. Visible in the southeastern sky. On December 1 it rises two hours before sunrise. By January 31 it is rising about 4:30 A.M. In conjunction with Saturn on January 23.

Jupiter: A bright object (mag. −1.4) in the morning sky. Rises about 3 A.M. during the first week of December. On January 20 it is in quadrature (90° west of the sun), rising around midnight on that date.

Saturn: Too near the sun for observation during December, being in conjunction with the sun on December 8. During mid-January it may be seen in the southeastern sky rising about 2 hours before sunrise. Magnitude + 0.7. On January 23 it is in conjunction with Mars (separation 1½°).

The bay around us

San Francisco Bay. By Harold Gilliam. Doubleday & Company, Inc., Garden City, New York. 1957. 330 pp. $4.50.

As characterizes the bay itself, there is so much packed into Harold Gilliam's *San Francisco Bay,* the touch of a less dedicated and able writer could have made it heavy going indeed. To the writer's great credit, there is no heaviness in Gilliam's account of the history, life and lore of California's vital inland sea.

Although Gilliam obviously thinks highly of his subject, his book is not a mere love song to San Francisco Bay. He considers all its aspects, including the brutality and vulgarity which at times marked the bay's past history.

Chapter 1 is a short introductory chapter which could hardly be better. It quickly sketches in the bay's major attributes and illustrates them with short vignettes which reflect the bay's fascination for Bay Area residents and visitors alike.

From there Gilliam begins, most properly, at the beginning. He relates, in poetic but precise prose, how the bay came to be. In a related chapter, Gilliam explores – while avoiding taking sides – the controversy which revolves around Sir Francis Drake and whether he discovered San Francisco Bay or Drake's Bay to the north.

After the discovery of the bay, whoever was responsible, representatives of many nations began to navigate their ships through the Golden Gate. Spaniards were the first "developers" of the bay but representatives of the British and Russian empires also sailed into the bay and were quick to see its great potential. However, Americans wrested the area from Mexican control in 1846 and just three years later, San Francisco, its name newly-changed from Yerba Buena, "exploded into a fury of activity unparalleled before or since."

The discovery of gold exploded the furious activity, of course, and it was then San Francisco Bay began to live up – as described by Gilliam – to the predictions of its early visitors.

The bay's development into a "Harbor of Harbors" is described in a particularly noteworthy chapter and one of the longest in Gilliam's book. It becomes clear why the bay is so called as Gilliam relates the various aspects of the bay's greatness: how it made San Francisco the capital and first metropolis of the new world on the Pacific; the hundreds of ships that enter it each year and the men who man them; the shipping fortunes amassed out of it and the men who made them; the sailors who use the bay for pleasure, and the Coast Guardsmen who act as "guardian angels of the bay's mariners, both amateur and professional."

One of this chapter's sections which Gilliam does particularly well is called The Passing of the Ferries. In this section, the reasons why Bay Area residents mourn the passing are carefully and clearly set down.

Other chapters deal with the bay's marine life, the changing shoreline (see page 2), and the islands in the bay. The final two chapters take up two aspects of the bay which are perhaps dearest to the hearts of Bay Area residents: the fog and the bridges. Gilliam puts into extremely well-chosen words what many Bay Area residents feel about these two features of the bay.

A review cannot include the vast amounts of factual and fascinating information Gilliam includes but it can say that the information is well-organized and presented in prose that comes close to placing San Francisco Bay on the same shelf with Rachel Carson's *The Sea Around Us* and Guy Murchie's *Song of the Sky.* The sole reason *San Francisco Bay* might not make this shelf lies in the fact that its subject matter is not more general.

Unfortunately, the book does not appear to have been put together with the same care as Gilliam used in writing it. The dust jacket photographs are excellent, but under the jacket, the book is of decidedly prosaic appearance. Perhaps the quality of the printing is at fault for this appearance because it is uneven in value from one page to the next and some of it is slightly muddy looking. G.B.B.

San Francisco Bay: A Pictorial Maritime History. By John Haskell Kemble. Cornell Maritime Press, Cambridge, Maryland. 1957. 195 pp., 350 photos, line drawings, maps, etc. $10.00.

In 1806, Dr. Georg Heinrich Langsdorff, visiting San Francisco Bay with a Russian expedition, made a drawing from his ship. In the foreground, Indians paddle by in a rush canoe, in the background is a small cluster of buildings that was the Presidio of San Francisco. Behind them what appears to be a trail winds inland over the hills and in the distance rises the familiar outline of Twin Peaks.

A water color made in 1837 by Jean Jacques Vioget shows the village of Yerba Buena – two houses. Eleven years later, in a map drawn by Augustus Harrison, Yerba Buena has become San Francisco, a city of approximately 20 blocks, skirted by California, Stockton and Vallejo streets and the bay.

By 1851, the official map of San Francisco proves the business district to have solidified into the city much as we know it today. With these, and other early records of the bay and its shores, we are, as it were, present at the birth of San Francisco.

In this fascinating picture history, it becomes graphically and dramatically apparent how the bay itself and the discovery of gold in Northern California became major forces in creating and shaping the cities of the bay area. It is a happy thing, indeed, that the beginnings of photography and the development of this area were so nearly coincident.

The first photograph in this book, taken in 1851, is a panoramic view from the Portsmouth Plaza area and shows some 800 ships lying in the harbor, many abandoned in the quest for gold. One after another, the photographs follow, an absorbing record of the growth of the bay area as reflected in its maritime industries.

Selection of the plates, introductory texts and a running commentary with the pictorial material is the work of a man admirably suited for the task. A professor in history at Pomona College, Dr. Kemble has a background of educational and naval experience which is more than made apparent by the book.

The various aspects of maritime life on the bay are developed in chapters dealing with the ports, the building and repair of ships, sailing and steam vessels, the navy, fishing and sport racing among others.

As an example of the art of book making, this may not be outstanding but as a collection of interesting facts and photographs, I would recommend it to all lovers of San Francisco and its ships. J.C.K.

Scientific Resources of the San Francisco Bay Area. International Science Foundation. Golden Gate Park, San Francisco. 104 pp. $5.00.

The 1957-58 edition of a publication which catalogues and describes the scientific and technological resources of the San Francisco Bay Area. Provides a much-needed blueprint of the area's rapidly developing scientific manpower and research facilities and also furnishes information designed to acquaint visiting scientists and executives with research projects under way. G.B.B.

The gift list

The Bird Watcher's Anthology. By Roger Tory Peterson. Harcourt, Brace and Company, New York. 1957. xv + 401 pp., frontis. in color and black-and-white illus. by the author. $7.50.

For the bird-lover on your gift list there could be no finer present than this handsome gathering from the writings of Sutton, Burroughs, Huxley, Kieran, Peattie, Teale, Beebe, Hudson, Audubon, Darwin, Thoreau, and many others—85 outstanding selections from the natural history and discovery of birds. (For a splurge, there is also a limited, numbered edition printed on rag paper, autographed by Mr. Peterson, and enclosed in a slipcase—at $18.50.)

The Monkey Kingdom: *An Introduction to the Primates.* By Ivan T. Sanderson. Hanover House, Garden City, New York. 1957. 200 pp., 78 photographs, incl. 35 in full color, and 12 drawings and 9 maps by the author. $6.95.

Zoologist, author, artist, and television personality, Ivan T. Sanderson has developed a large following among the public, contributing much to the growing interest in the world of nature. In this world nothing interests most people more than our cousins the apes and monkeys. This introduction to them is designed to increase interest with knowledge and appreciation in an area that has been beset more than most others with misinformation and confusion. Generously illustrated as it is, this is a book for extended yet lively reading, drawn in good part from the author's own experiences all over the world.

Living Reptiles of the World. By Karl P. Schmidt and Robert F. Inger. Hanover House, Garden City, New York. 1957. 287 pp., 266 photographs, incl. 145 in full color. $10.00.

Each year brings notable additions to the sum of splendidly illustrated, authoritative, and popular volumes of natural history in its various branches, such as this one on the reptiles which follows in the same series as Ivan T. Sanderson's *Living Mammals of the World* and *The Monkey Kingdom*. The conclusion is inevitable that there exists a sufficient public demand to warrant a large investment in costly plates, especially the full color that appeals most strongly to the buying eye. The present volume is particularly attractive, and its authorship insures the quality of its considerable descriptive text (the late Karl P. Schmidt was Curator of Zoology, Emeritus, and Robert F. Inger is Curator of Reptiles, in the Chicago Natural History Museum). D.G.K.

Edward Palmer: *Plant Explorer of the American West.* By Rogers McVaugh. University of Oklahoma Press, Norman, Oklahoma. 1956. 430 pp. 15 photos, 2 maps. $6.00.

Edward Palmer was one of the great natural history collectors of the last century. However, his greatest claim to fame is for his botanical collections which consist of about 100,000 items. In addition to these he collected uncounted thousands of ethnobotanical, archeological, and zoological items.

His collecting spanned 57 years from 1853 to 1910 and it included areas of the southwestern United States, plus other areas such as Texas, Kentucky, and Florida, northern Mexico and, to a lesser extent, Argentina, Brazil, and Paraguay. Because Palmer's collections were so extensive, made over such a long period of time and in so large a geographical area, it has been difficult sometimes for those working on them to place them by locality and date. Important as his collections always have been, there never has been compiled a full account of Palmer's life or of his collection data.

Dr. McVaugh became interested in Palmer about 1940 and in his words "the present compilation was undertaken in an attempt to assemble and arrange, and make readily available, some of the widely scattered data pertaining to the life of Edward Palmer, and to provide documentation not for a single collection but for a collector." Many references and sources of information, including Palmer's field notes and his letters, were consulted to bring together the two major portions of this book, an account of Palmer's life and travels and a geographical index to the localities where he collected.

Several appendices contain some of Palmer's field notes, a chronology of his plant collections, a list of herbaria having significant holdings of Palmer collections, and his last will and testament. A valuable and interesting feature of the book is the short biographical sketches of botanists, zoologists, and others whose paths in some way crossed that of Palmer. The tremendous amount of information and data, all documented, makes this book a most valuable reference work. The account of Palmer's life is interesting not only for the facts about Palmer, but as a chapter in the history of botany during the second half of the last century. E.Mc.

Hunters of the Stormy Sea. By Harold McCracken. Doubleday & Company, Inc. Garden City, New York. 1957. 312 pp. $4.50.

One of the most colorful and at the same time tragic stories in North American history involves an animal known as the sea otter. It was January 24, 1725, when, at the command of Peter the Great of Russia, Captain Vitus Bering began an expedition to seek a route to the New World across a sea that was later to bear his name.

He returned to St. Petersburg from this unsuccessful mission on March 1, 1730, and was again commissioned to lead another similar but more extensive expedition. After eight and a half years of preparation, two ships, the St. Peter and the St. Paul, set sail from the coast of Kamchatka. Bering was aboard the St. Peter. The two ships finally became separated from one another and, on June 16, 1741, the St. Paul sighted the Alaskan coast. Thirty-six hours later and three hundred miles to the north Bering and his crew had their first view of what is now known as Mt. St. Elias.

Although the St. Paul and its crew returned to Kamchatka the St. Peter became wrecked on the Commander Islands. Here the crew was forced to endure the hardships of an Alaskan winter which resulted in the loss of many lives, including that of Captain Bering. Those who survived owed their lives to the presence of the sea otters that inhabited the waters about these islands. The otters provided the crew with food and with fur for clothing.

When the survivors finally succeeded in returning to Kamchatka in August of 1742, stories of the fabulous fur-bearing animals that inhabited the Commander Islands, as well as the Aleutians and the coast of Alaska, spread throughout Asia and Europe.

Harold McCracken's *Hunters of the Stormy Sea* tells us about the hordes of Russian fur seekers that came to the islands and mainland of Alaska to make their fortune. Their ruthless treatment of the natives as well as the animals they sought is an ugly blot on the history of colonization in North America. It finally terminated, however, with the settlement of Ft. Ross along the California coast and the almost complete extermination of the animal whose fur was held in such high esteem.

Anyone interested in the early history of the Pacific Northwest will find in this book a wealth of carefully documented information presented in the form of a narrative. R.T.O.

World's greatest art

A publishing program of signal accomplishment and promise which we have been privileged to report in these pages, the Unesco World Art Series, is of sufficient scope to have included Australian aboriginal rock paintings, delicate Persian miniatures, and robust decoration of early Christian churches in Norway. Two of the most exciting subjects, we think, are coming soon: early Sinhalese paintings from Ceylon (Arthur C. Clarke gave us a "preview" in The Reefs of Taprobane, *you will recall) and ancient Buddhist paintings of Japan. The slant has been towards art proceeding, as though a natural phenomenon, from the deepest experiences of a people, those involved with the ordering of life under divine or supernatural guidance where such ordering is the warp of the web of life. Great art comes from man's farthest reachings into the mysteries of his life and thus is part of the natural history of man.*

Unesco World Art Series: Vol. VII. Spain: Romanesque Paintings. Preface by Walter W. S. Cook. Introduction by Juan Ainaud. The New York Graphic Society (by arrangement with Unesco), Greenwich, Conn. 1957. 29 pp. + 32 full-color plates. $16.50.

The medieval church frescoes of this volume are characterized by their resounding vigor of color and design. Deep red browns and olive greens give them an earthiness which is in keeping with a subtle aura of humor — who can say whether intended or not? — which is inescapable to this viewer at least, and which lends the universal touch. Artists of the World Art Series are generally nameless; one must look for roots in the people and its times.

Identical in format but not given as part of the Series is the following:

Masaccio: *Frescoes in Florence.* Introduction by Philip Hendy. The New York Graphic Society (by arrangement with Unesco). Greenwich, Conn. 1956. 22 pp. + 32 full-color plates. $16.50.

Early Californiana

Once a year or so it has been our custom to catch up with the peripatetic publishing project of Glen Dawson (550 S. Figueroa St., Los Angeles 17) known to librarians and collectors as the Early California Travels Series. We've had hints that Glen and Muir, the brothers Dawson of the widely known Book Shop, had no idea what they were starting a few years back, with their number I and a prospectus to subscribers. Anyone with a complete set has a good investment; many of the numbers are out of print, including some of those listed below, so that we can only advise those interested in subscribing or buying available issues to write Dawson's Book Shop for the latest bulletin. Because of doubtful print status, we have omitted prices. Each book is an item of typographic as well as historical and bibliographic interest. We take the Series from where we left it two years ago:

Early California Travels Series. Glen Dawson: Los Angeles, 1955-1957.

XXXI. **The American Occupation of La Paz.** By Don Meadows. 1955. 31 pp., illus. with drawings by William Rich Hutton. The Mexican War in Baja California, ending on a romantic note.

XXXII. **California All the Way Back to 1828.** By Michael C. White. Written by Thos. Savage for the Bancroft Library 1877. Introduction & Notes by Glen Dawson. Illustrations by Clarence Ellsworth. 1956. Robust reminiscences of one of California's first foreign settlers, as told to an H. H. Bancroft compiler; valuable source material, here printed in full for the first time.

XXXIII. **Memoirs of José Francisco Palomares.** Translated from the manuscript in the Bancroft Library by Thomas Workman Temple II. 1955. 69 pp., illus. Incidents in the life of a Californio, including the Battle of San Pascual as seen from his side.

XXXIV. **Adventures in California of Zakahar Tchitchinoff 1818-1828.** Introduction by Arthur Woodward. 1956. xxix + 26 pp., wood-engravings in color by the printer, Mallette Dean. Rousing days of the Russian sea otter hunters.

XXXV. **Voyage of the *Venus:* Sojourn in California:** *Excerpt from* Voyage autour du monde sur la frégate *Vénus* pendant les années 1836-1839 *by Abel du Petit Thouars.* Translated by Charles N. Rudkin. 1956. xiii + 113 pp., illus. Visit to Monterey and voyage down Baja California's coast during one of the most notable of French voyages touching California.

XXXVI. **Diary of Titian R. Peale, From Oregon to California, 1841.** By Clifford M. Drury. Introduction by Carl Dentzel. (This volume not at hand as we write.)

XXXVII. **Observations on California 1772-1790.** By Father Luis Sales, O.P. Translated and edited by Charles N. Rudkin. 1956. xiii + 218 pp., annotated and indexed. "An important source book which has been one of the most inaccessible of all the printed sources of California history."

XXXVIII. **Crusoes of Pitcairn Island:** *The Shipwreck Diary of Captain Josiah N. Knowles, Master of the California Clipper* Wild Wave, *1858.* Edited by Richard S. Dillon. 1957. 45 pp., illus. From the original log of a Pacific seaman who became well known in the San Francisco Bay area.

XXXIX. **The 'Nonpareil' Press of T. S. Harris.** By Richard E. Lingenfelter and Richard A. Dwyer. 1957. xii + 59 pp., illus. Life and times of one of California's famous pioneer printer-publishers.

XL. **Remarkable Adventures: California, 1845.** By Capt. Daniel D. Heustis. With an Introduction by Carey S. Bliss. 1957. ix + 22 pp. Larkin, Sutter, Fallon, and others appear in this brief account of a chance visit.

From the reader

EDITOR, *Pacific Discovery:*

"The Story of Mission 66" is another chapter in your valiant struggle for conservation.

Increasing hordes of visitors plus "Automania" are both a boon and a curse of our national parks. I hope that in trying to accommodate these visitors our park service will not forget the basic principle of the national park system. This principle is first of all preservation of a natural area or a man-made object in its virgin and intact state. Superfacilitation for the visitors comes second.

This came to my mind because right now Mt. Rainier is threatened with a ski lift and expanding overnight facilities at the Paradise which would, of course, impair the unique beauty of our loveliest mountain. Such examples can be multiplied.

In Europe this basic principle has been followed very successfully and is well understood by the prospective visitors. Perhaps we could learn from the Europeans a few other things than how to make "Sputniks"!

BORYS MALKIN
University of Minnesota
Minneapolis, Minn., 23 Oct. 1957

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Errata

Sept.-Oct.—fac. 1: We apologize to Alan McClure. Correct title for cover photo should read: "Comet Cherbak-Mrkos as seen from Frazier Mountain near Los Angeles on the night of August 13-14, 1957. (Photo by Alan McClure.)" Photo title on page 28 should read: "Comet Cherbak-Mrkos from Frazier Mountain, 22-23 August 1957. (Photo by Alan McClure.)"

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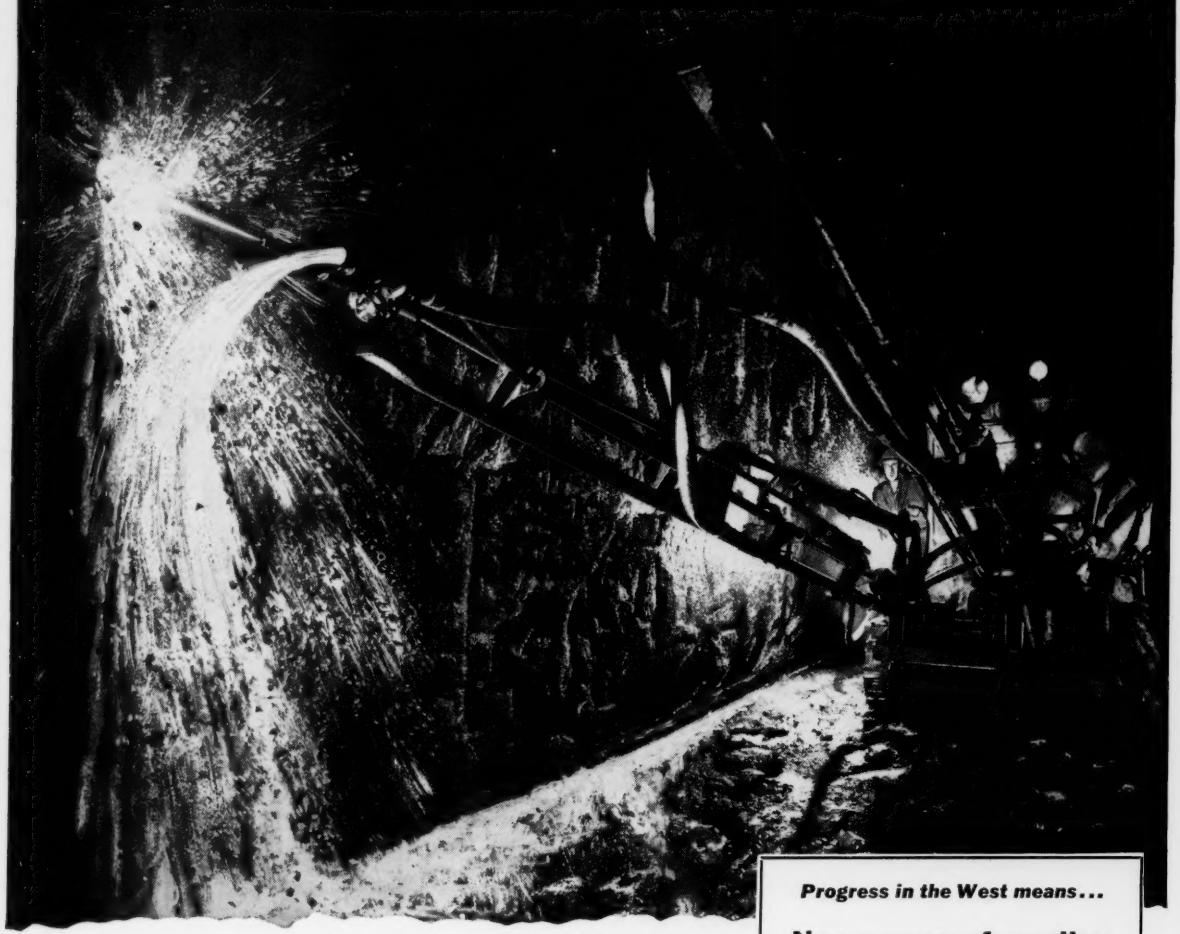

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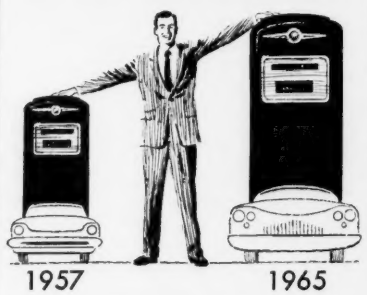

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